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FRESNO COUNTY STREAM GROUP
CALIFORNIA

MAINTENANCE MANUAL

BIG DRY CREEK RESERVOIR
AND
DIVERSION



SACRAMENTO DISTRICT
CORPS OF ENGINEERS
U. S. ARMY
SACRAMENTO, CALIFORNIA

MAINTENANCE MANUAL
BIG DRY CREEK RESERVOIR AND DIVERSION PROJECT
FRESNO COUNTY STREAM GROUP, CALIFORNIA

Prepared in the Sacramento District
Corps of Engineers, U. S. Army
Sacramento, California, dated 20 May 1952

Approved by the Office, Chief of Engineers, 11 March 1953

E. D. FILE _____

REVISIONS

Date	New Pages or Exhibits	Date Approved by S.P.D.
1 Apr. 58	Added Drop Structures and Side Erosion Control Structures.	
1 Apr. 58	Added Sheets 29 through 33 of Exhibit	
1 May 58	Other minor revisions to conform to OCE Memorandum ENG.S: "Safety Provisions in Operations and Maintenance Manuals" dated 27 April 1954.	

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MAINTENANCE MANUAL
FRESNO COUNTY STREAM GROUP, CALIFORNIA
BIG DRY CREEK RESERVOIR AND DIVERSION

PART A

1. Authorization. The Big Dry Creek Reservoir and Diversion Project was authorized by Act of Congress (Public Law No. 228, Seventy-Seventh Congress, chapter 377, First Session) approved 18 August 1941. The authorization was based upon a report entitled: "Fresno County Stream Group, California," printed as House Document No. 845, Seventy-Sixth Congress, Third Session. The initial appropriation in the amount of \$435,000 was contained in the first Deficiency Appropriation Act of 1946, approved 28 December 1945.

2. Project location. The Big Dry Creek reservoir and diversion project is located on Big Dry and Dog Creeks about 12 miles northeast of the City of Fresno in Fresno County, California. The project location is shown on drawing file No. SJ-1-110-48, of Exhibit A-1. The streams on which the project is located rise in the lower mountain areas and emerge from the foothills near Academy about 14 miles northeast of Fresno. Below the foothill line, the channels become very shallow and capacities diminish progressively, becoming too small to be of significance after passing the western city limits of Fresno. Below the project, the channels are crossed by large irrigation canals which head on Kings River near the foothill line. These canals divert all ordinary flows in the creeks. At the foothill line, and crossing part of the project area, is a

reach of the United States Bureau of Reclamation's Friant-Kern canal which conveys San Joaquin River water from Millerton Lake southerly toward the Kern River area.

3. Project description. The project includes a diversion structure with controlled outlet on Dog Creek, and a diversion dike and channel from Dog Creek to Big Dry Creek for the purpose of controlling and diverting Dog Creek flood flows into Big Dry Creek; a dike along Big Dry Creek between the Dog Creek diversion dike and the head of the reservoir to confine Big Dry Creek and diverted Dog Creek flows; a detention reservoir, with a gross storage capacity of 16,000 acre-feet, on Big Dry Creek to control the combined flood flows of Big Dry Creek and Dog Creek; an outlet structure on the southerly side of the reservoir to permit passage of ordinary flows down Big Dry Creek; facilities, consisting of an outlet structure on the westerly side of the reservoir, a partially leveed channel extending therefrom to Little Dry Creek and five drop structures located in the Outlet Channel for releasing water to Little Dry Creek and provide the principal outlet for the disposal of floodwaters stored in the reservoir; and a spillway located in a natural saddle at the northwest extremity of the reservoir to prevent the reservoir from rising, as a result of rare floods in excess of the project design flood, above the maximum safe level.

4. Protection provided. The project controls a drainage area of 86 square miles. It is designed to protect the city of Fresno, California, and adjoining areas from damaging floodwaters by reducing

the flood flows of Dog Creek and Big Dry Creek so that the flows in the network of downstream channels of the Fresno County Group will not exceed non-damaging amounts. The project design flood of Big Dry and Dog Creeks has a peak flow of 4,180 cubic feet per second and a volume of 22,800 acre-feet, this being about 58 percent greater than the maximum historical flood (March 1938) of these streams. Floods larger than the project design flood will be rare and will be substantially reduced from the size which would prevail under pre-project conditions.

5. Construction history. The construction of the project was accomplished under four major contracts, copies of which are on file in the office of the District Engineer, Sacramento District, Sacramento, California. Pertinent data on the four contracts involved follow:

a. Construction contract

Contract No. - W-04-167-eng-1234
Specification No. - 1241
Contractor - H. Earl Parker, Inc.
Work started - 15 May 1947
Work completed - 27 February 1948

b. Supply contract - Outlet Gates

Contract No. - W-04-167-eng-1246
Specification No. - 461 (0)
Contractor - Pacific Coast Engineering Co.
Work started - 3 March 1947
Work completed - 15 October 1947

c. Drop structures construction

Contract No. - DA-04-167-eng-881
Specification No. - 1710
Contractor - Trewhitt-Shields & Fisher
Work started - 16 October 1952
Work completed - 1 April 1953

d. Side erosion control structures contract

Contract No. - DA-04-167-eng-1053
Specification No. - 1786
Contractor - Gordon L. Capps
Work started - 16 July 1953
Work completed - 26 September 1953

e. Gaging facilities - construction contract

Contract No. - DA-04-167-eng-1248
Specification No. - 1897
Contractor - H. Sykes
Work started - 3 December 1954
Work completed - 28 February 1955

6. Local cooperation requirements. The Act of Congress authorizing the project reads in part as follows:

"The project for the Fresno County Stream Group is hereby authorized to be constructed substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 845, Seventy-Sixth Congress, Third Session,"

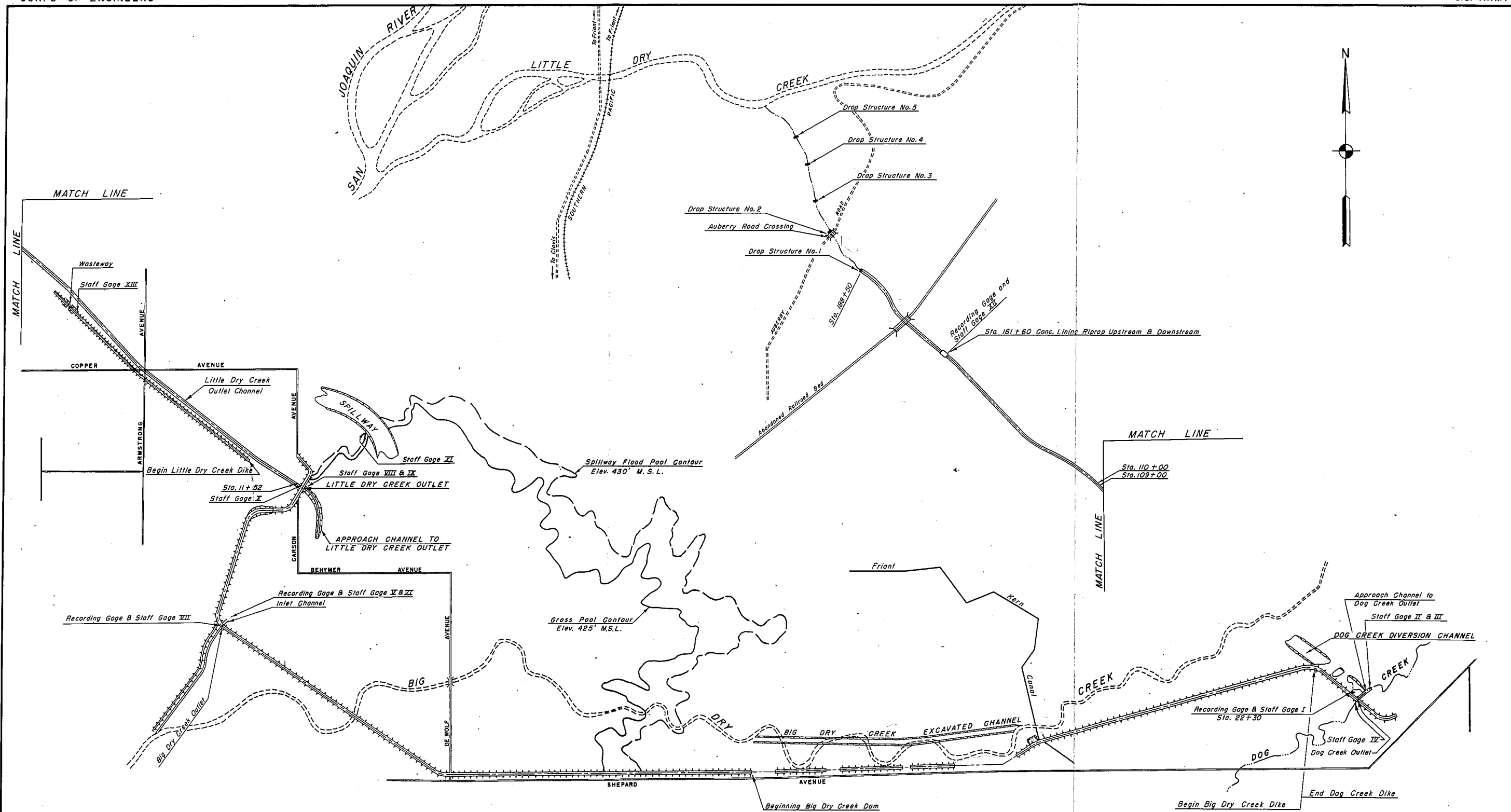
7. Project document. The Chief of Engineers by recommendations contained in House Document No. 845 established the following conditions of local cooperation:

"That responsible local agencies give assurances satisfactory to the Secretary of War that they will provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the project, hold and save the United States free from claims for damages due to the construction of the works and their subsequent operation and maintenance, bear expense of bridge construction, and maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of War."

8. Assurances provided by local interests. The Reclamation Board of the State of California by an Agreement of Assurances to

the Secretary of War, dated 11 March 1947, (Exhibit B-4-1) gave assurances that it would comply with all requirements of local co-operation. These assurances were accepted by the Secretary of War on 18 March 1947.

9. Acceptance of project. By letter dated 19 March 1948 the United States turned over the completed project to the State Reclamation Board for maintenance and operation in accordance with the provisions of the provisions of the authorizing Federal Act. By resolution dated 7 April 1948 (Exhibit B-4-2 and B-4-3), the State Reclamation Board accepted the project for maintenance and operation, and also turned the project over to the County of Fresno for maintenance and operation in accordance with the contract and agreement dated 6 August 1946 between the State Reclamation Board and the County of Fresno (Exhibit B-4-4 and B-4-5). The five drop structures in Little Dry Creek outlet channel were turned over to the State Reclamation Board of the State of California by letter dated 13 April 1953.



GRAPHIC SCALE
1000 0 1000 2000 FEET

BIG DRY CREEK RESERVOIR
FRESNO COUNTY STREAM GROUP, CALIFORNIA

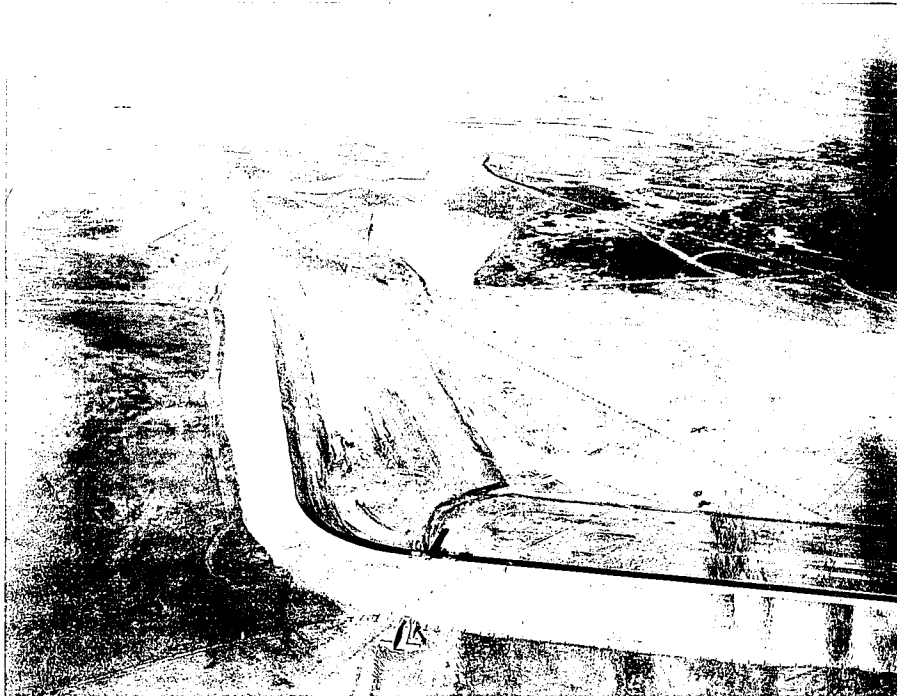
PLAN OF BIG DRY CREEK RESERVOIR AND DIVERSION

Corps of Engineers Sacramento, California

Prepared by: A.G.C.

26 May 1953
Revised 1 September 1955
Revised 1 February 1958

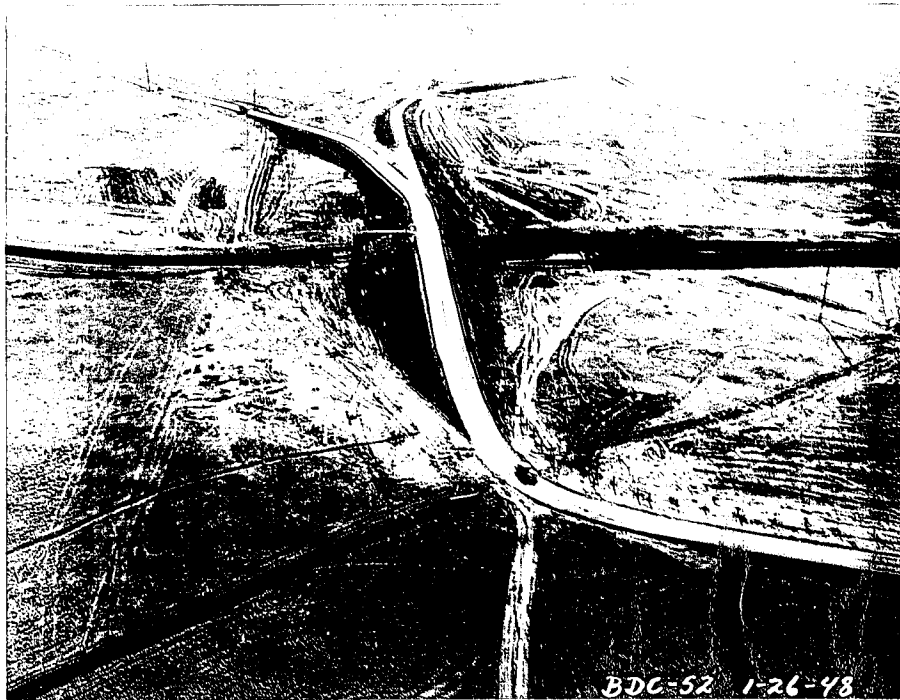
File No. SJ-1-26-126



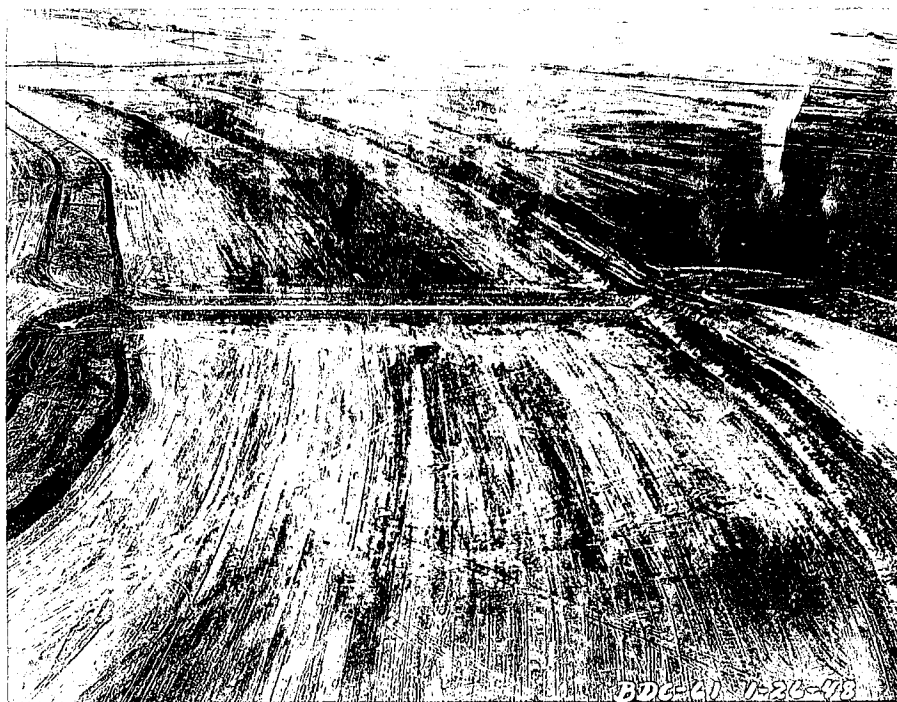
BDC-44 Aerial. Big Dry Creek Dam. Big Dry Creek Outlet in foreground. Looking upstream (north).



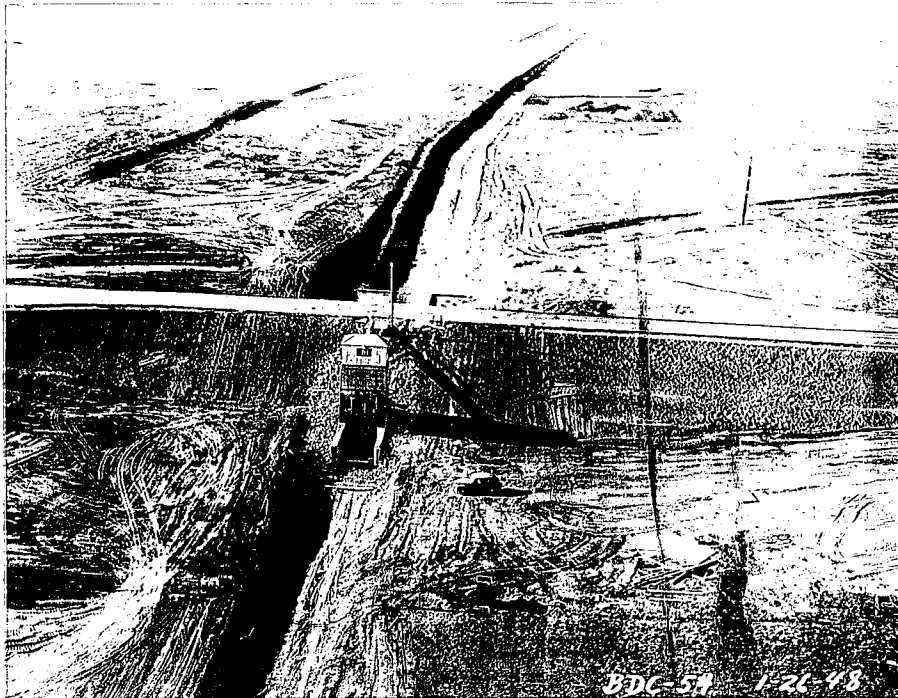
BDC-46 Aerial. Big Dry Creek Intake. Outlet channel in background. Looking downstream (southwest).



BDC-52 Aerial. Big Dry Creek Dam and Little Dry Creek Outlet. Looking southwest.



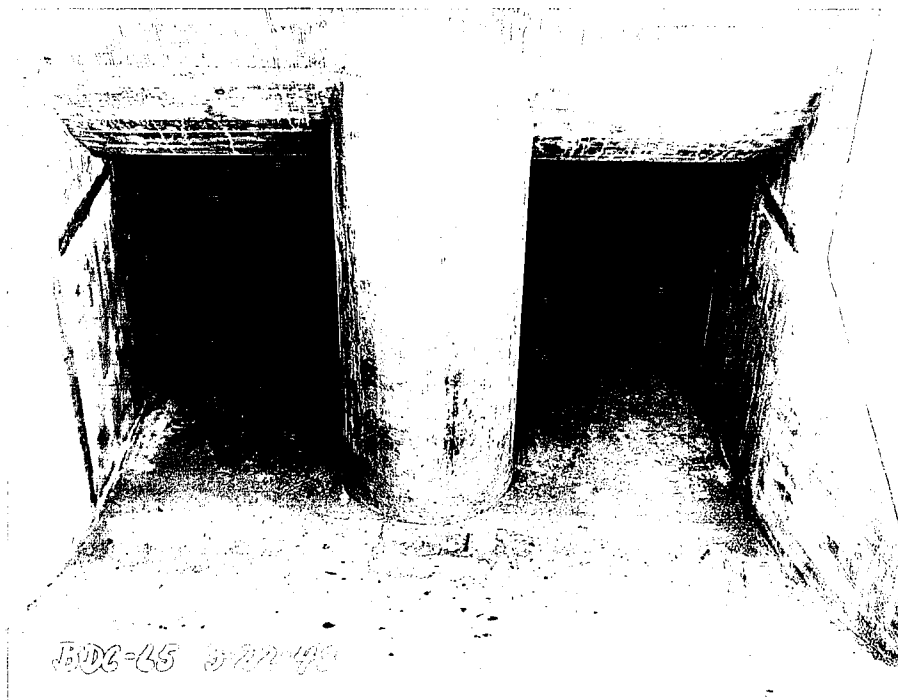
BDC-61 Aerial. Big Dry Creek Reservoir Spillway looking northwest. (Downstream)



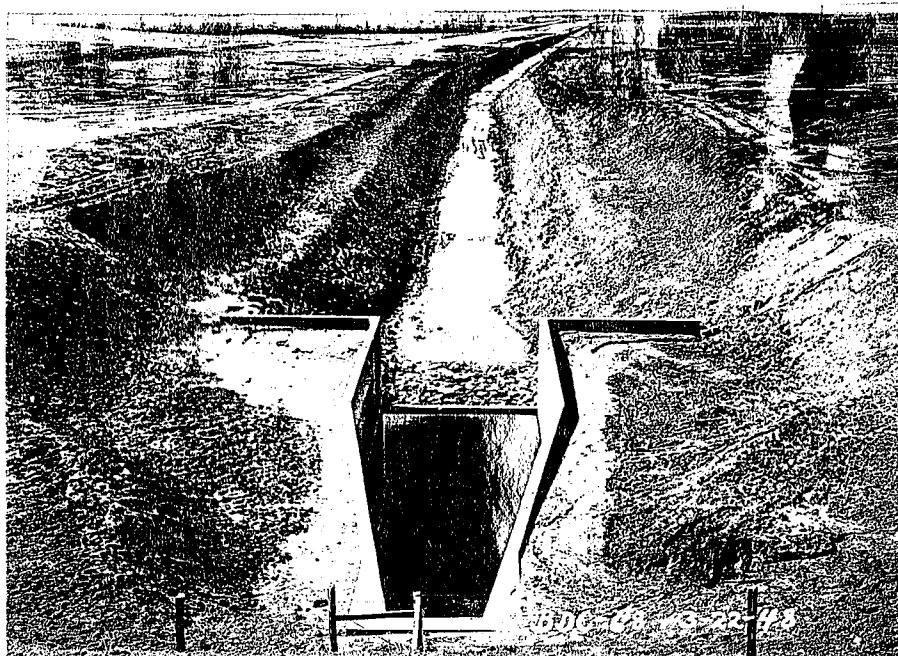
BDC-54 Aerial. Little Dry Creek Outlet looking downstream (northwest).



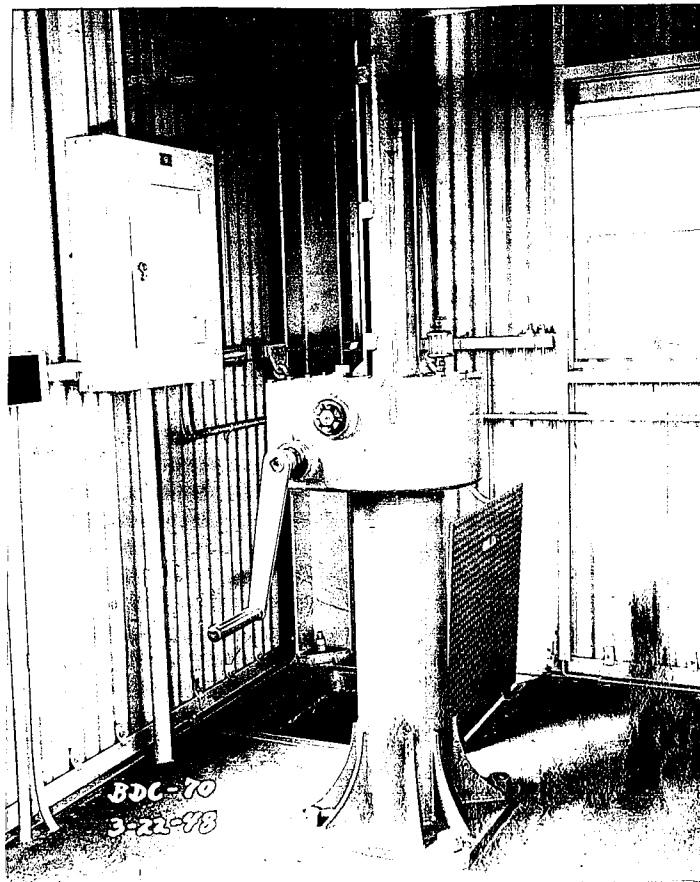
BDC-55 Aerial. Little Dry Creek Outlet looking upstream (southeast).



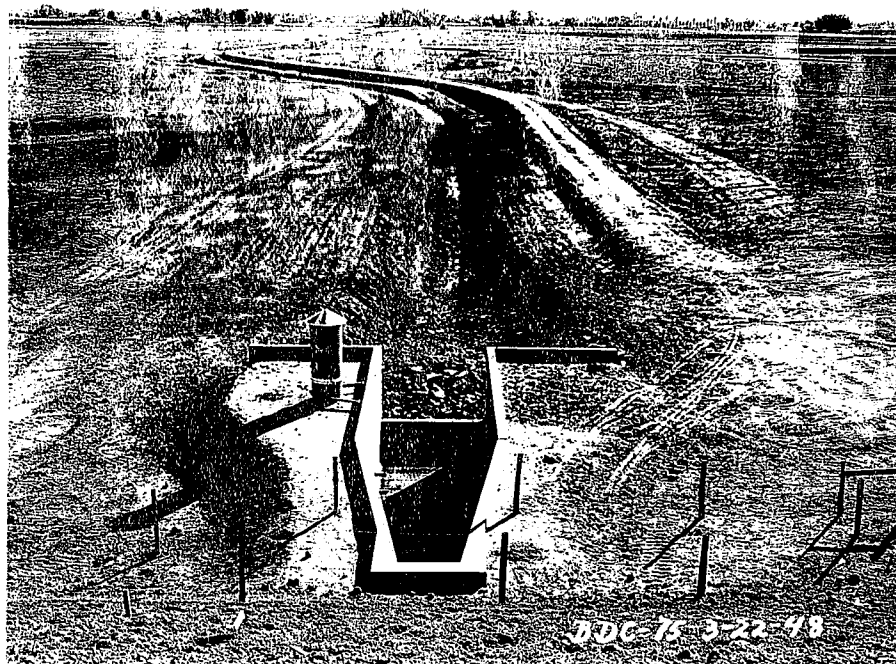
BDC-65 Little Dry Creek Outlet Structure looking into intake. Looking downstream (west).



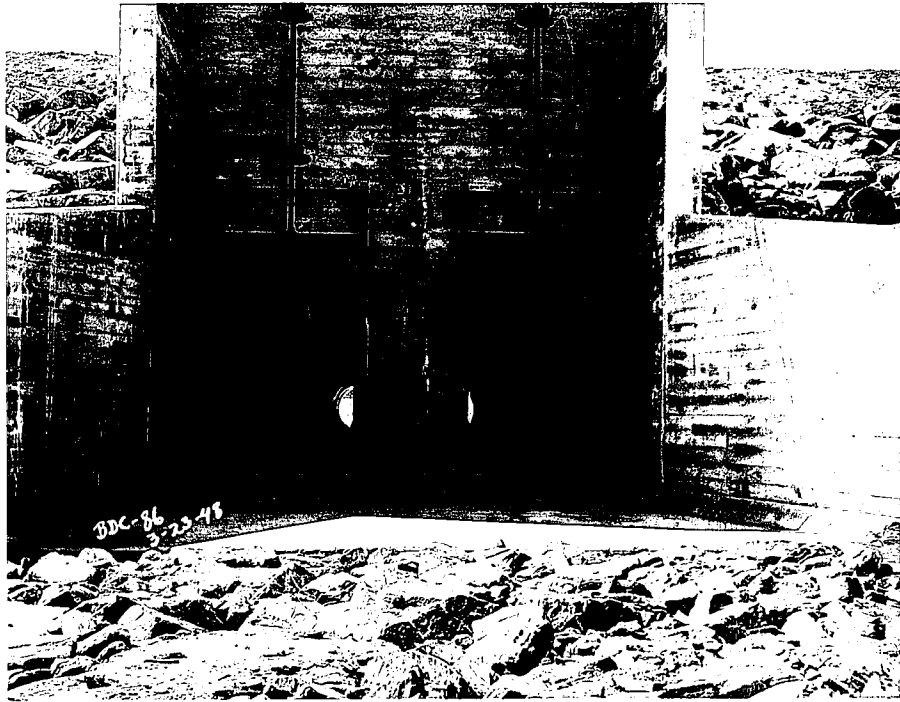
BDC-68 Little Dry Creek Outlet Structure looking at downstream outlet channel. Looking downstream (west).



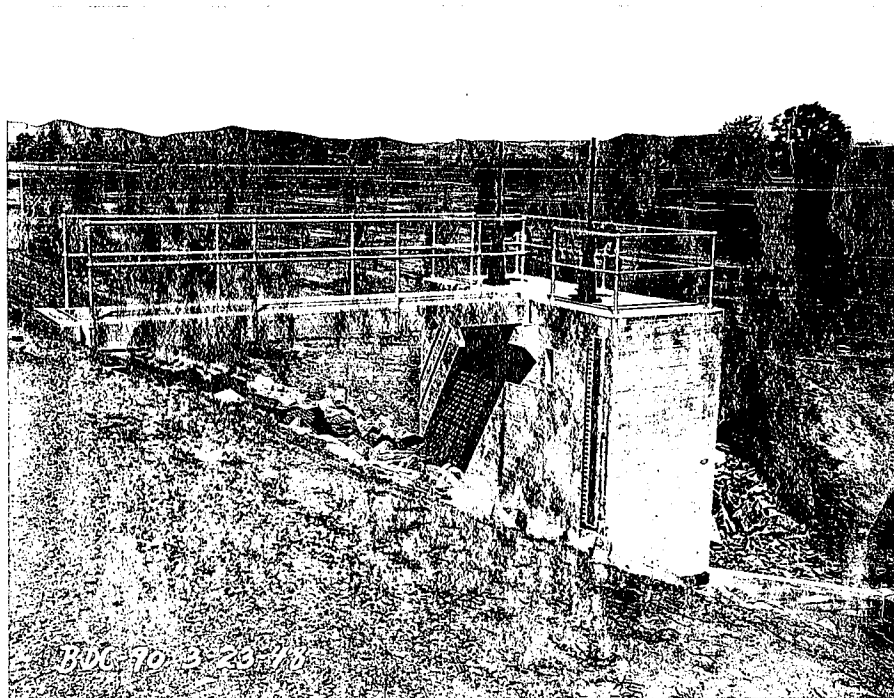
BDC-70 Little Dry Creek Outlet Structure - left side of entrance. Hand-operated Hoist.



BDC-75 Big Dry Creek Outlet Structure looking downstream at outlet channel (south).



BDC-86 Dog Creek Outlet Structure looking downstream
(south).



BDC-90 Dog Creek Outlet Structure looking upstream
(northwest).

PERTINENT DATA

BIG DRY CREEK RESERVOIR AND DIVERSION PROJECT

1 February 1958

a. General

Name Big Dry Creek Reservoir and Diversion

Streams Dog Creek

Big Dry Creek

Drainage areas

Dog Creek 16.6 sq. miles

Big Dry Creek 69.6 sq. miles

Total at reservoir. 86.2 sq. miles

Little Dry Creek outlet channel 5.0 sq. miles

Total for project 91.2 sq. miles

b. Reservoir

Elevation

Gross pool. 425.0 feet

Spillway flood pool 430.0 feet

Taking line 435.0 feet

Area

Gross pool. 1,530 acres

Spillway flood pool 1,940 acres

Taking line 2,390 acres

Storage capacity

Gross pool. 16,250 ac-ft

Spillway flood pool 24,900 ac-ft

Taking line 35,700 ac-ft

c. Spillway (Unlined channel with concrete
Sill control section)

Crest length. 450.0 feet

Side slopes 1 on 1.5

Crest elevation 425.0 feet

Discharge at pool elevation 430.0 13,300 c.f.s.

d. Embankment (earthfill)

Main Dam

Crest elevation 435.0 feet

Freeboard above spillway flood pool 5 feet

Maximum height (foundation to crest). 40 feet

Length of crest 20,000 feet

Width of crest. 15 feet

Slopes

Upstream face above elevation 425.0 1 on 2
Upstream face below elevation 425.0 1 on 2.5
Downstream face 1 on 2

Big Dry Creek Dike

Crest elevation varies
Freeboard above maximum water surface 3 feet
Maximum height foundation to crest. 10 feet
Length of crest 14,520 feet
Width of crest. 25 feet
Side slopes 1 on 2

Dog Creek Dike

Crest elevation 491.0 feet
Freeboard above maximum water surface 5 feet
Maximum height foundation to crest. 19 feet
Length of crest 2,500 feet
Width of crest. 15 feet
Side slopes 1 on 2

Big Dry Creek Outlet Dike

Crest elevation varies
Length of crest 2,983 feet
Width of crest. 10 feet
Side slopes 1 on 2

Little Dry Creek Outlet Dike

Crest elevation 400.50 feet
Freeboard above breastwall. 3 feet
Maximum height foundation to crest(approx.) . 13 feet
Length of crest 6,750 feet
Width of crest. 10 feet
Side slopes 1 on 2
Wasteway (Uncontrolled breast wall)
Crest length. 50 feet
Side slopes 1 on 1.5
Crest elevation of breast wall. 397.34 feet
Overflow capacity at elev. 400.5
(top of dike). 840 c.f.s. /

e. Channels

Dog Creek Diversion (excavated channel)

Length. 2,400 feet
Bottom width. 340 feet
Side slopes 1 on 2
Berm width (minimum). 29.5 feet
Bottom elevation. 479.50 feet
Capacity. 5,000 c.f.s.

Approach Channel to Dog Creek Outlet Structure

Length. 400 feet
Bottom width. 20 feet
Side slopes 1 on 1.5

Big Dry Creek Excavated Channel

Length. 6,500 feet
Bottom width. 100 feet
Side slopes 1 on 2

Approach Channel to Big Dry Creek
Outlet Structure

Length. 290 feet
Bottom width. 10 feet
Side slopes 1 on 1.5

Big Dry Creek Outlet Channel

Length. 2,798 feet
Bottom width. 14 feet
Side slopes 1 on 2
Invert elevation at outlet structure. 394.50 feet
Outlet elevation at Big Dry Creek
intersection. 393.0 feet
Slope 0.000536 ft/ft

Little Dry Creek Outlet Channel

Stations 11+52 to 109+00 Excavated channel

Length. 9,748 feet
Bottom width. 20 feet
Side slopes 1 on 1.5
Capacity with three feet of freeboard . . . 708 c.f.s.

Stations 109+00 to 110+00 (Transition)

Length. 100 feet
Bottom widths
Station 109+00 20 feet
Station 110+00 12 feet

Stations 110+00 to 188+50

Length. 7,850 feet
Bottom width. 12 feet
Side slopes 1 on 1.5
Capacity. 700 c.f.s

Excavated Open Ditch below Auberry Road Crossing

Length (approx.). 2,500 feet
Bottom width. 15 feet
Side slopes 1 on 1.5
No. of Concrete drop structures 5

f. Outlets

Dog Creek Outlet (twin circular concrete conduits)

Size. 48" dia.
Intake elevation, invert. 472.0 feet m.s.l.
Outlet elevation, invert. 471.50 feet m.s.l.
Length. 64 feet
Gates (Slide), number and size. 2 @ 4' x 4'
Capacity
 at Diversion channel invert elev. 479.5 . . . 303 c.f.s.
 at Design pool level elev. 485.5. 450 c.f.s.

Big Dry Creek Outlet (Rectangular concrete conduit)

Size. 4' x 5'
Elevation of inlet control weir 400.0 feet
Intake elevation, invert. 395.0 feet
Outlet elevation, invert. 394.50 feet
Length. 117.5 feet
Gate (Slide), number and size 1 @ 4' x 5'
Capacity
 at pool elevation 405.0 263 c.f.s.
 at gross pool elevation 425.0 590 c.f.s.
 at spillway flood pool elevation 430.0. . . 644 c.f.s.

Little Dry Creek Outlet (Rectangular concrete conduit)

Size. 6' x 5'
Elevation of inlet control weir 405.0 feet
Intake elevation, invert. 395.0 feet
Outlet elevation, invert. 394.0 feet
Length. 117.5 feet
Gates (Slide), number and size. 2 @ 4' x 5'
Capacity
 at elevation 413.5 (3,200 ac-ft). 700 c.f.s.
 at gross pool elevation 425.0 940 c.f.s.
 at spillway flood pool elev. 430.0. 1,020 c.f.s.

Approach Channel to Little Dry Outlet

Length. 1,500 feet
Bottom width. 20 feet
Side slopes 1 on 1.5

PART B

INSPECTION AND MAINTENANCE - GENERAL PROCEDURE

10. Reference to approved regulations. This manual for the maintenance of Big Dry Creek reservoir and diversion works is furnished in accordance with provisions of Title 33 - Navigation and Navigable Waters, Chapter II, Corps of Engineers, Department of the Army, Part 208 - Flood Control Regulations, Maintenance and Operation of Flood Control Works, approved by the Secretary of War, 9 August 1944 and published in the Federal Register, 17 August 1944. A copy of this Title is included in this manual as Exhibit B-2. Reservoir operation and regulation plans, when approved by the Secretary of the Army and published in the Federal Register, will be appended hereto and will also be included in a separate supporting "Reservoir Regulation Manual".

11. Purpose of this manual. The general regulations referred to in paragraph 10 were established by the Secretary of the Army in order that local interests may be fully aware of the extent of the obligations assumed by them in furnishing assurances of local cooperation for flood-protection projects authorized by Congress. They are intended to be sufficiently broad in scope and general in nature as to be applicable to all of the many local flood protection projects for which such regulations are required by law. Section 208.10 (a) (10) of the regulations reads as follows: "The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist

them in carrying out their obligations under these regulations". Therefore, the purpose of this manual is to furnish local interests with information on the project works, and advice as to the details of the operation and maintenance requirements applicable to this particular project, to state procedures required by the Department of the Army, and to indicate satisfactory methods of flood-fighting operations and emergency repairs. The project works are to be maintained and operated in accordance with the Flood Control Regulations referred to above, and interpretations thereof which are applicable to this project and contained herein.

12. Definitions. As used hereinafter the term "Superintendent" shall mean the person appointed by local interests to be directly in charge of an organization which will be fully responsible for the continuous inspection, operation, and maintenance of the project works; the term "District Engineer" shall mean the District Engineer of the Sacramento District, Corps of Engineers, U. S. Army, or his authorized representative. "Flood Season" is considered to be the period between 1 November and 30 April, and "Major High Water Period" is considered to be one in which the reservoir water surface has risen above elevation 414.0.

13. General provisions of regulations. In addition to the provisions quoted in paragraph 11 and 12 above, the general provisions of the Flood Control Regulations, contained in paragraphs 208.10(a)(2) to 208.10(a)(9) inclusive are quoted as follows:

"(2) The State, political subdivision thereof, or other responsible local agency, which furnished

assurance that it will maintain and operate flood control works in accordance with the regulations prescribed by the Secretary of the Army, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent", who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

- "(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.
- "(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.
- "(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or

construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer, or if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

- "(6) It shall be the duty of the Superintendent to submit a semi-annual report to the District

Engineer covering inspection, maintenance and operation of the protective works.

"(7) The District Engineer or his authorized representative shall have access at all times to all portions of the protective works.

"(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

"(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods."

14. Assistance to be furnished by the District Engineer. The District Engineer will:

a. Furnish to the Superintendent "As Constructed" drawings of the project works at the time they are transferred or as soon thereafter as possible.

b. Make periodic inspections of the project works and notify the Superintendent of any repairs or maintenance measures which the District Engineer deems necessary in addition to the measures taken by the Superintendent.

c. Make prior determination that any proposed encroachment, improvement, excavation, or construction within the right-of-way

or alteration of the project works, will not adversely affect the functioning of the protective facilities and to furnish the Superintendent with an approval thereof in writing.

d. Assist the Superintendent, as may be practicable, in his duties of ascertaining storm developments having flood producing potentialities, assembling flood fighting forces and materials, and initiating and carrying out flood fighting operations. In this connection, it is recommended that the Superintendent obtain information as to storm developments and their predicted magnitude by telephonic liaison with the Fresno office of the United States Weather Bureau at Fresno Airport, Fresno, California.

15. Responsibilities of the Superintendent. In line with the provisions covered by the regulations, the general duties of the Superintendent shall include the following:

a. Training of key personnel. Key personnel shall be trained in order that regular maintenance work may be performed efficiently and to insure that unexpected problems related to flood control may be handled in an expeditious and orderly manner. They shall become familiar with: Federal Flood Control Regulations; this manual for maintenance of the project; Water Level Recorder Bulletins; the project construction specifications; the project "As Constructed" drawings; and nomenclature of slide gate parts and appurtenances. The Superintendent shall have available the names, addresses, and telephone numbers of all his key men and a reasonable number of substitutes. These key men shall in turn have similar data on all of the men that will be necessary for assistance in the

discharge of their duties. The organization of key men shall include the following:

- (1) An assistant to act in the place of the Superintendent in case of his absence.
- (2) Section foremen in sufficient number to lead maintenance patrol work of the entire project during flood fights. High qualities of leadership and responsibility are necessary for these positions.

The Superintendent shall inform the District Engineer annually, on 15 October, of the names and telephone numbers of personnel and their substitutes who will be responsible for operation of the outlet structures gates during the flood season, 1 November to 30 April.

b. Files and records. The Superintendent shall maintain a file of all reports, records, and drawings concerning the project works. A complete log is to be maintained of reservoir operation data recording the time and amount of all gate changes, reservoir stages, estimated releases, change in maximum permissible rate of release from each of the outlets and all operating decisions. The files and records are to be available at all times to the District Engineer.

c. Encroachment or trespass on right-of-way. In accordance with the provisions of Flood Control Regulations 208.10(a)(4), no encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted on the rights-of-way of the protection facilities. The Superintendent shall, therefore, cause notices to be posted at conspicuous places along the project right-of-way directing public attention to this

regulation. The Superintendent shall arrange for the prosecution of offenders under local ordinances and shall report actions taken to the District Engineer.

d. Permits for right-of-entry or use of portion of right-of-way. Requests for permits for temporary right-of-entry or use of portions of the right-of-way shall not be issued without prior determination by the District Engineer that such use will not adversely affect the safety and functioning of the project structures or maintenance and flood fighting operations. Regulations governing issuance of permits for use of rights-of-way for flood protection projects are contained in Exhibit B-3. Applications for such permits shall be submitted by the Superintendent to the District Engineer sufficiently in advance of issuance to permit adequate study and consideration and determination of conditions to be embodied in the permit document. Executed copies, in triplicate, of the permit document as issued shall be furnished the District Engineer.

e. Permits for improvements or construction within the project right-of-way. All requests for permits for construction of any improvement of any nature within the limits of the project right-of-way shall be referred to the District Engineer for determination that such construction will not adversely affect the stability, safety, and functioning of the protective facilities and for definition of conditions under which permit should be granted. These conditions will include among others the following items:

- (1) That all work shall be in accordance with the following:

- (a) Standard engineering practice and in accordance with plans and specifications approved by the District Engineer or his authorized representatives.
- (b) Drawings or prints of proposed improvements or alterations to the existing flood control works approved by the District Engineer.
- (2) After completion of the work, "As Constructed" drawings or prints, in duplicate, showing such improvements as finally constructed shall be furnished the District Engineer.

A sample permit form is attached in Exhibit B-3.

f. Coordination of local activities. The Superintendent shall, during periods of flood flow, coordinate the functions and activities of all agencies, both public and private, that are connected with the protective works. Arrangements shall be made with the local enforcement agencies, street departments, and railroad and utility companies for developing a coordinated flood-fighting program, and an outline of this program shall be filled with the District Engineer.

g. Inspection and maintenance.

- (1) The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Periodic inspections shall be made by the Superintendent to insure that the above maintenance

measures are being effectively carried out. Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Immediate steps shall be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

- (2) The check lists shown in Exhibit B-8 should be used in each inspection to insure that no features of the protective system are overlooked. Items requiring maintenance should be noted thereon; if items are satisfactory they should be indicated by a check. Carbon copy of the inspectors original field notes as recorded on the check list shall be transmitted to the District Engineer immediately following each inspection and one copy included as an inclosure to the semi-annual report as provided in paragraph 15 h (1) of this manual.
- (3) All repairs shall be made in accordance with standard engineering practice, to line and grade, and in accordance with details shown on construction drawings for the project works, copies of which are included in Exhibit B-12.

- (4) Full responsibility for making of repairs and methods used is placed on the Superintendent, but the experience and facilities of the Corps of Engineers will be available to him for advice and consultation.

h. Reports.

- (1) Semi-annual report. The Superintendent shall submit, within a 10-day period following 1 May and 1 November of each year, a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

This report shall present a statement of:

- (a) The physical condition of the protective works as summarized from the logs of inspection.
- (b) Flood behavior of the protective works, and flood-fighting activities during the flood season.
- (c) Prosecutions for encroachment or trespass.
- (d) Permits issued for right-of-entry or use of right-of-way.
- (e) Permits issued for improvements or construction within the project right-of-way.
- (f) Maintenance measures taken; nature, date of construction and date of removal of temporary repairs, date of permanent repairs.

- (g) Fiscal statement of cost of maintenance and operation for the period. A suggested form for submission of the semi-annual report is included as Exhibits B-6-1 and B-6-2.

16. Features of the project subject to flood control regulations.

General. The flood control works covered by this manual are known as the Big Dry Creek reservoir and diversion project and consist of a dam and auxiliary dikes, excavated channels, controlled outlets, spillway and miscellaneous features. The controlled outlet and diversion structure on Dog Creek, the 2,500-foot long Dog Creek dike and the 2,400-foot long Dog Creek diversion channel, provide the means of controlling and diverting Dog Creek flows into Big Dry Creek. The Big Dry Creek dike extending from Dog Creek dike about 14,520 feet to the head of the Big Dry Creek reservoir, confines the Big Dry Creek and diverted Dog Creek flows. Improvement in the alignment of Big Dry Creek was accomplished by the construction of a 6,500-foot long excavated channel located opposite the lower reach of Big Dry Creek dike. Provisions for a 16,250 acre-foot capacity detention reservoir, to control the combined flows of Big Dry and Dog Creeks, was made by construction of the approximately 20,000-foot long Big Dry Creek dam extending from high ground near the end of Big Dry Creek dike to high ground near the Little Dry Creek outlet channel. A controlled outlet and diversion structure on the south-erly side of the reservoir provides the means of releasing ordinary flows of Big Dry Creek; an outlet channel and dike provides the means of returning such releases to the existing downstream channel of

Big Dry Creek. A controlled outlet and diversion structure on the westerly side of the reservoir near the end of the Big Dry Creek dam provides the principal outlet for the disposal of floodwaters stored in the reservoir; the 17,700-foot long Little Dry Creek outlet channel conveys such releases to the existing channel of Little Dry Creek which discharges into the San Joaquin River. A dike 6,750 feet in length is constructed along the southerly bank of Little Dry Creek outlet channel from station 25+00 to station 92+50 to confine design flows within the excavated channel. A spillway located in a natural saddle at the northwest extremity of the reservoir provides a safety outlet for possible storage resulting from rare floods in excess of the project design flood. The various items of the project are discussed in more detail in the following paragraphs.

17. Dam and dikes.

a. General. Included in this group are the Dog Creek dike, Big Dry Creek dike, Big Dry Creek dam, Big Dry Creek outlet channel dike, and Little Dry Creek outlet channel dike. All embankment sections are constructed from homogeneous material borrowed from areas adjacent to the dam and dikes. All embankment sections have been seeded to provide protection against rain and wave wash.

b. Description.

- (1) Dog Creek dike. Plan, profile and sections are shown on drawings No. SJ-1-111-91 and SJ-1-112-54 of Exhibit B-12. Dog Creek dike begins at station 8+00 and extends to station 33+00 a distance of 2,500 feet. It has a maximum height of

19 feet and a crest elevation of 491.0. The side slopes of the section are 1 on 2, both upstream and downstream. The crest width is 15 feet between stations 8+00 and 25+00; from station 25+00 to station 33+00, it increases uniformly to 25 feet. A 12-foot wide, 6-inch thick gravel roadway traverses the length of the dike, a paved ramp is constructed at station 16+00 to provide access to staff gage No. IV, and a ramp at station 26+50 provides a farmers' crossing over dike. The embankment section is provided with a downstream toe drain across Dog Creek between station 19+50 and 26+50. The details of this drain are shown on drawing SJ-1-117-71 of Exhibit B-12. The upstream slope of the embankment section is protected with a 24-inch thickness of riprap, from the toe to elevation 488.50 for a distance of 38 feet at the Dog Creek diversion structure, station 19+80.

- (2) Big Dry Creek dike. The plan, profile, and section for this dike are contained on drawings SJ-1-111-91 and SJ-1-112-54 of Exhibit B-12. The Big Dry Creek dike, a noncontinuous levee, begins at station 33+00, the end of Dog Creek dike, and extends to station 178+20 a distance of 14,520 feet. A

12-foot wide, 6-inch thick gravel roadway is provided between station 33+00 and station 107+70 with a turn-around at station 40+00. The maximum height of the embankment section is 10 feet with crest elevations varying as follows:

<u>Station</u>	<u>Crest Elevation</u>
33+00	491.0
41+00	486.1
59+00	481.6
93+50	470.0
157+20	450.8
178+20	442.0

The dike has a 25-foot crest width and side slopes of 1 on 2. The dike is discontinued between the following stations as the existing topography is high enough to provide closure:

Station 117+00 to 134+00
Station 144+00 to 148+00
Station 161+00 to 166+00
Station 173+00 to 175+00

The Friant-Kern Canal, a unit of the Bureau of Reclamation's Central Valley Project, crosses Big Dry Creek dike near station 110+00. The invert grade of the canal at the dike crossing is about 458.0 and the top of the dike is at elevation 465.0.

- (3) Big Dry Creek dam. Big Dry Creek dam is located as shown on drawing file No. SJ-1-111-91 of Exhibit B-12. The section starts at station 186+12 and extends 20,038 feet to station 386+50. The

crest elevation is 441.0 at station 186+12, and slopes downward on a uniform grade to elevation 435.0 at station 198+00; from station 198+00 to the end of the dam the crest elevation is 435.0. The upstream side slopes are 1 on 2 and the downstream side slopes are 1 on 2 above elevation 425.0 and 1 on 2-1/2 below elevation 425.0. The top width of the dam is 15 feet, and the maximum height is 40 feet. A rock toe drain extends 400 feet along the downstream slope of Big Dry Creek dam between stations 291+00 and 295+00 (the abandoned channel of Big Dry Creek). Details of the drain are contained on drawing file No. SJ-1-117-117 of Exhibit B-12. An approximate 4-foot thick impervious blanket extending 200 feet upstream from toe of the dam is provided across the old channel of Big Dry Creek to increase the path of percolation under the dam. The upstream slope of the dam section is provided with a 24-inch thick layer of riprap from the toe to elevation 425.0 for a distance of 38 feet at both the Big Dry Creek diversion structure and the Little Dry Creek diversion structure. A 12-foot wide, 6-inch thick, gravel road traverses the dam between stations 263+00 and 386+50, its end. As shown on profile

drawing file No. SJ-1-112-54, Exhibit B-12, the dam intercepts high ground and is discontinued between the following stations: station 354+00 to station 356+20, station 356+80 to station 358+80, station 363+80 to station 367+80, station 369+20 to station 370+60, and station 374+80 to station 375+30. The gravel road along the crest of the dam is continued across the high ground areas. Paved ramps are provided at station 264+00 for access to Shepard Avenue, and to DeWolf Avenue. Also, there is a ramp at station 303+00 for a farmers' crossing and one at station 378+00 for access to Carson Avenue. A turn-around and parking area are constructed at station 355+00. The crest roadway is extended from the end of the dam, station 386+50, about 700 feet on a minus 6 percent slope to connect with Carson Avenue.

- (4) Big Dry Creek outlet dike. This dike parallels the Big Dry Creek outlet channel, along its westerly bank, and extends approximately 185 feet beyond the end of the channel. The dike is 2,983 feet long and has a crest width of 10 feet and side slopes of 1 on 2. Location of the dike is shown on drawing SJ-1-111-91 of Exhibit B-12.
- (5) Little Dry Creek outlet channel dike. The plan, profile and section of this dike is shown on drawing

SJ-1-114-57 of Exhibit B-12. The dike is 6,750 feet in length and has a crest width of 10 feet, and 1 on 2 side slopes. The crest elevation is 400.5. A 6-inch thick, 10-foot wide gravel roadway extends from the upper end of the dike, station 25+00, to the Little Dry Creek outlet channel wasteway structure at station 86+00. Access to the dike from Copper and Armstrong Avenue is provided by ramps, D, E, F, and G near station 60+00. Drawing SJ-1-117-119 of Exhibit B-12 shows the details of these ramps.

c. Inspection and Maintenance.

- (1) Periodic inspections shall be made by the Superintendent or his authorized representative to insure that:
 - (a) No unusual settlement, sloughing or material loss of grade or levee cross-section has taken place;
 - (b) No caving has occurred on either the landside or the riverside of the levee which might affect the stability of the levee section;
 - (c) No seepage, saturated areas or sand boils are occurring;
 - (d) Toe drainage systems are in good working condition, and that such facilities are not becoming clogged;

- (e) Drains through the levee and gates on the drains are in good working condition;
 - (f) No revetment work or riprap has been displaced, washed out or removed;
 - (g) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will prevent or retard the growth of sod;
 - (h) Access roads to and on the levee are being properly maintained;
 - (i) Cattle guards and gates are in good condition;
 - (j) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;
 - (k) There is no unauthorized grazing or vehicular traffic on the levee;
 - (l) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.
- (2) To insure the taking of such maintenance measures as will be required for proper functioning of the embankment sections, the following items shall be specifically covered in each inspection:
- (a) Settlement, sloughing or material loss of grade or embankment cross section;

- (b) Erosion of embankment slopes;
 - (c) Presence of seepage, saturated areas, or sand boils back of levee;
 - (d) Condition of sod cover;
 - (e) Condition of access roads;
 - (f) Condition of toe drains and riprap.
- (3) Maintenance methods to be used for repair or reconstruction of embankment fill will depend on the extent of the damaged section. If of small extent, the most suitable method will be to bring the embankment back to line and grade by a fill made in 6-inch layers of coarse granular material, such as sand and gravel. If of larger extent, the fill shall be made in the same manner as the original construction with homogenous material from borrow pits approved for the project, and placed in uniform horizontal layer not more than 6 inches in depth and compacted to a density equal to the original embankment section.
- (4) A vigorous sod which covers the entire embankment and protective berm is one of the most effective means of protecting such areas against erosion and wave wash. Large weeds and brush shall not be permitted to grow on the embankment. Mowing to keep weeds and brush under control shall be accomplished in May and August or more often if

necessary, to assure a good sod cover. Grass clippings shall be left on the areas being mowed. If large weeds and brush become established because of lack of proper maintenance these shall be cut and removed from the dam or dikes for disposal and no cuttings shall be burned on the levee. Infertile bare areas may be treated by mulching with manure containing a straw or straw alone plus seeding or sodding. If straw mulch is used, a suitable commercial fertilizer will greatly hasten the establishment of a protective sod cover.

- (5) Burrowing animals found in the embankments shall be exterminated. The dens and runways shall be opened up, then thoroughly compacted as they are backfilled. Methods of extermination by trapping and poisoning are usually effective. Advice concerning the best methods in each locality can be obtained from the county agricultural agent.
- (6) Access roads and ramps shall be properly maintained so that ordinary maintenance work and flood fighting operations will not be obstructed.
- (7) It is important that the toe drains across Dog Creek and Big Dry Creek be kept functioning properly. In the event the drains become clogged and seepage through the embankment section occurs, the District Engineer shall be consulted for analysis and recommendation of remedial measures.

d. Flood emergency inspection.

- (1) During flood periods, embankments shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:
 - (a) There are no indications of slides or sloughs developing;
 - (b) Wave wash or scouring action is not occurring;
 - (c) No low reaches of levee exist which may be over-topped;
 - (d) No other conditions exist which might endanger the structure;
 - (e) Appropriate advance measures are being taken to insure the availability of adequate labor and materials to meet all contingencies, and immediate steps are being taken to control any condition which endanger the levee and to repair the damaged section.
- (2) It shall be the duty of the Superintendent to maintain a continuous patrol of the project work during all periods of flood flow during which the water stage in the reservoir reaches elevation 425.0 or in excess thereof, and to maintain a store of supplies and equipment available for emergency flood-fighting operations and emergency

repairs. The Superintendent shall dispatch a message by radio, telephone, telegraph, or other rapid means of communication to the District Engineer whenever the water surface reaches the flood state indicated above, and also keep him advised at frequent intervals of project conditions until the reservoir stage recedes to a safe level.

18. Channels.

a. General. The channel improvements in this project consist of the Dog Creek diversion channel, approach channel to Dog Creek outlet structure, Big Dry Creek excavated channel, approach and outlet channels for Big Dry Creek outlet structure, Little Dry Creek outlet channel and approach channel to Little Dry Creek outlet structure and two channels connecting borrow areas.

b. Description.

- (1) Dog Creek diversion channel. The location of this channel is shown on drawing No. SJ-1-111-91 of Exhibit B-12. The centerline of the Dog Creek diversion channel is parallel to and is located at a minimum distance of 230 feet to the northerly or upstream from the centerline of the Dog Creek dike. The channel begins opposite station 19+80 and extends in a straight line 2,400 feet downstream. The trapezoidal channel has a bottom width of 340 feet and side slopes of 1 on 2. The elevation of the bottom of the channel is 479.5.

(2) Approach channel to Dog Creek outlet structure.

The approach channel to the Dog Creek outlet structure is trapezoidal in shape with a 20-foot bottom width and 1 on 1-1/2 side slopes. The channel is 400 feet long extending from a 100-foot long tangent in Dog Creek to the riprapped intake section of the Dog Creek outlet structure. See drawing SJ-1-111-91 for the location of this approach channel.

(3) Big Dry Creek excavated channel. A plan and profile of this channel is shown on drawing No.

SJ-1-111-91 and SJ-1-112-54 of Exhibit B-12. The channel was constructed for the purpose of eliminating the meandering alignment of the existing Big Dry Creek channel and to improve the hydraulic properties of the stream. The channel is located 500 feet northerly or upstream from Big Dry Creek dike. The trapezoidal-shaped channel starts opposite dike station 109+50 and extends downstream about 6,500 feet parallel to Big Dry Creek dike. The bottom width of the channel is 100 feet and the side slopes are 1 on 2. The invert of the channel is on a uniform grade from elevation 452.0 at the upper end to elevation 431.0 at the lower end. The excavated channel intersects the old stream channel in four locations

as shown on drawing No. SJ-1-111-91. These areas are filled with earth plugs.

(4) Approach and outlet channels to Big Dry Creek outlet structure.

(a) Approach channel. The location of the approach channel is shown on drawing No. SJ-1-111-91 of Exhibit B-12. It is opposite the main dam station 335+11.04. The trapezoidal channel is about 290 feet long, has a 10-foot bottom width and 1 on 1-1/2 side slopes. The grade varies from elevation 392.8 in borrow area "D" to elevation 398.0 at the concrete inlet to the outlet structure.

(b) Outlet channel. This channel returns reservoir releases to the downstream channel of Big Dry Creek. The outlet channel is trapezoidal in shape, and is 2,798 feet long. The bottom width is 14 feet and the side slopes are 1 on 2. The invert grade slopes from elevation 394.5 at the outlet structure to elevation 393.3 where the channel intersects the existing Big Dry Creek.

(5) Little Dry Creek outlet channel. The location, plan, profile and sections of this channel are shown on the following drawings of Exhibit B-12:

SJ-1-110-48
SJ-1-111-91
SJ-1-111-92
SJ-1-114-57

This channel conveys flows released from the Big Dry Creek reservoir through the Little Dry Creek outlet structure to Little Dry Creek which discharges into the San Joaquin River. The trapezoidal-shaped channel is 17,700 feet in length extending from the outlet structure in Big Dry Creek dam to a point where the channel ends in a natural draw leading to Little Dry Creek. The channel has a bottom width of 20 feet from its beginning, station 11+52, to station 109+00 where it narrows to a 12-foot width to station 188+50, and end of the channel. The side slopes are 1 on 1-1/2 and the grade of the channel varies as follows

<u>Station</u>	<u>Elevation</u>
11+52	391.0
30+00	390.29
110+00	387.54
188+50	385.78

A 20-foot long section of the trapezoidal channel (station 161+50 to 161+70) is lined with 6" thick concrete lining. The depth of the lined section is 13 feet. The lining is protected with cutoff walls and riprap at each end. The lined portion serves as a control section for the gaging station.

- (6) Approach channel to Little Dry Creek outlet structure. The location of this channel is shown on drawing No. SJ-1-111-91 of Exhibit B-12. The trapezoidal channel is about 1,500 feet long, has a bottom width of 20 feet and side slopes of 1 on 1-1/2. The invert grade of the channel is uniform from its beginning in the reservoir area (elevation 400.0) to the riprap inlet section of the Little Dry Creek outlet structure (elevation 403.0).
- (7) Channel connecting borrow areas. There are two short, excavated channels; one channel connects borrow areas C and D and the other connects borrow area D with Big Dry Creek. The location of these channels are shown on drawing No. SJ-1-111-91 of Exhibit B-12. The channel connecting borrow areas C and D is 647 feet long, has a bottom width of 12 feet and a side slope of 1 on 2-1/2 on the northerly side and a side slope of 1 on 3 in the southerly bank. The grade of this channel slopes from elevation 403.1 in borrow area C to elevation 402.4 in borrow area D. The channel connecting borrow area D with Big Dry Creek is 186 feet long, has a bottom width of 45 feet and side slopes of 1 on 2. This channel has a uniform grade from elevation 403.1 in Big Dry Creek to elevation 402.4 in borrow area D.

c. Inspection and maintenance.

(1) Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

- (a) The channel or floodway is clear of debris, weeds, and wild growth;
- (b) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;
- (c) The capacity of the channel or floodway is not being reduced by the formation of shoals;
- (d) Banks are not being damaged by rain or wave wash and that no sloughing of banks has occurred;
- (e) Riprap sections and deflection dikes and walls are in good condition;
- (f) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works;
- (g) Immediate steps are taken to remedy any adverse conditions disclosed by such inspections, and that measures be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes.

- (2) The purpose of the flood-flow channel inspection is to insure that conditions which affect the channel capacity will remain, as far as reasonably possible, the same as those considered in the design assumptions and that no new conditions develop that may affect the efficient functioning and stability of the project structures. At each inspection, particular attention shall, therefore, be given the following:
- (a) Location, extent and size of vegetal growth;
 - (b) Unauthorized operations within the flood-flow channel right-of-way such as excavations, buildings and other structures, levees, bank protection, or training dikes;
 - (c) Rubbish disposal;
 - (d) Changes in the channel bed, such as aggradations or degradations which would interfere with free flow through the outlet structures and road crossing culverts;
 - (e) Erosion of the concrete lined section (gaging station) of the Little Dry Creek outlet channel;
 - (f) Operations of any nature upstream from the project on either Dog Creek or Big Dry Creek that would affect flow conditions within the limits of the flood control project.

- (3) To insure that vegetal matter, if dislodged, will not seriously clog the outlet structures, the road crossing culverts, and the waterway under the farm bridge, it shall be cut and removed from the channel when inspection discloses it to be a hazard.
- (4) Shoaling or aggradation at the outlet structures and road crossing culverts shall be removed.
- (5) Channels and rights-of-way are to be kept reasonably clear of debris and all other refuse matter.
- (6) All eroded concrete shall be repaired as soon as reinforcing steel is exposed or if erosion approaches a depth of 2 inches. For this purpose it is recommended that the repair be made by thoroughly cleaning the surface, by sandblasting and building up the section by the gunite process.
- (7) All damage to fencing, whether resulting from accidental or willful injuries or from corrosion, shall be promptly repaired with new material.

19. Outlet structures.

a. General. Outlet structures in the project consist of the Dog Creek, Big Dry Creek and Little Dry Creek outlet works, a reservoir spillway and a wasteway in the Little Dry Creek outlet channel dike.

b. Description.

- (1) Dog Creek outlet structure. This facility is located at station 19+80 in the Dog Creek dike. Details of the outlet works are shown on drawings SJ-1-114-64 and SJ-1-114-65 of Exhibit B-12. The structure consists of a riprapped inlet channel section, a reinforced concrete intake section, a gate chamber and hoist platform with access bridges, concrete pipe conduits through the dike, reinforced concrete outlet section and a riprapped exit channel section. The riprapped inlet channel section is a 10-foot long trapezoidal section with a 20-foot bottom width and 1 on 1-1/2 side slopes. The riprap is 24 inches thick and is placed on a 6-inch thick filter blanket. The concrete intake, approximately 8 feet long, is a flared transition section with a bottom width of 20 feet at the riprapped channel to 14 feet at the gate chamber. The wing walls of the section are 9 feet in length and extend into each bank of the channel. The vertical training walls connect the wing walls to the gate chamber side walls. The elevation of the apron is 471.0. The gate chamber is a three walled 6' x 14' rectangular-shaped tower extending 20 feet above the floor of the inlet apron. It houses two circular

opening sluice gates. They are Calco Rectangular Gates, Model 173, stock number 920 with the following principal dimensions: Opening height 48 inches, width 48 inches; overall height, 57 inches; width 57 inches; height of frame above centerline of gate, $81\text{-}\frac{1}{8}$ inches; diameter of stem, $1\text{-}\frac{3}{4}$ inches. The gates are manually operated by Calco hoists located on a platform over the control tower. The hoists are the Calco Double-Geared Pedestal Gate Lift, Model 291, stock number 1137, with gear ratio of 9:1, and the following principal dimensions: diameter of stem, 2 inches; overall height $36\text{-}\frac{1}{4}$ inches; height of nut $7\text{-}\frac{1}{4}$ inches. The gates and hoists are manufactured by the Armco Steel Corporation, Berkeley, California. Access to the gate hoists is provided by a 4-foot wide by 19-foot long structural steel foot bridge decked with subway grating and provided with pipe hand railings. Details of the bridge are shown on drawing SJ-1-114-67 (Exhibit B-12). The 62-foot long conduit through the dike consists of two parallel 48-inch diameter precast concrete pipes supported by concrete collars at 16 foot centers. The conduit invert elevation at the gates is 472.0 and the invert elevation at the

outlet is 471.5. The 19-foot long outlet section provides a transition from a 14-foot bottom width at the end of the conduits to a 20-foot width at the outlet channel. The apron elevation is 471.0 and the top of the training walls and wing walls are at elevation 477.0. The wing walls extend into the channel banks and are 9 feet long. The riprapped exit channel is a trapezoidal section 24 feet long. The bottom width is 20 feet and the side slopes are 1 on 1-1/2. The section is protected with a 3'-6" thickness of riprap over a 6" thick filter blanket.

- (2) Big Dry Creek outlet structure. This structure is located at station 335+11.04 in the Big Dry Creek dam. Details of the outlet works are shown on drawings SJ-1-114-61, 62 and 63 of Exhibit B-12. The principal features include a riprapped inlet channel, a concrete inlet with ogee weir, a gate tower with control house and access bridge, a concrete conduit through the dam, and energy dissipator, and a riprapped exit channel section. The riprapped inlet channel section is trapezoidal-shaped with a 10-foot bottom width and 1 on 1-1/2 side slopes. The protection consists of 24" of riprap on a 6" thick filter blanket. The concrete inlet consists of a 10-foot long ogee section with

a crest elevation of 400.0. Wing walls extend 8 feet into the channel banks; a 10-foot wide rectangular channel formed by vertical training walls extends 10 feet from the upstream face of the ogee section then converges in a distance of 10 feet, to a 4-foot width at the gate chamber. The top of floor elevation of the section is 395.0 and the top of the walls vary from elevation 406.0 at the wing walls to elevation 414.0 at the upstream face of the control tower. The inside dimensions of the gate tower are 7'-0" x 7'-0" in plan. The tower extends to elevation 435.0, the top of the dam. A steel grille door, size 3'-6" x 7'-0", is provided in the side of the tower to facilitate removal of the slide gate for future maintenance work. Details of this grille are shown on drawing No. SJ-1-114-67 of Exhibit B-12. The service gate is a 4' x 5' metal slide gate. Air is supplied to the gate by a 10" vent pipe. The gate is manually operated by a stem screw hoist in the control house. Both the gate and hoist were manufactured by Pacific Coast Engineering Company, Alameda, California. Details of the gate assembly are shown on the drawings of Exhibit B-13. The control

house is a corrugated metal structure, size 8'-6" x 8'-6" x 8'-0" high, placed on the gate tower. Details of the construction are shown on drawing No. SJ-1-114-66 of Exhibit B-12.

Access from the main dam roadway to the control house is provided by a 36 feet long by 4'-8" wide structural steel bridge the details of which are shown on drawing No. SJ-1-114-67 of Exhibit B-12.

The conduit through the embankment section consists of a 20-foot long intake section with a bell-mouthed entrance. The invert grade is 395.0. The regular 4' x 5' rectangular conduit section connects with the intake section and continues through the dam, and is 117.6 feet long. The invert grade at the outlet is 394.5. The conduit was constructed in sections with collars and expansion joints at 23'-6" centers. The conduit discharges into a concrete jump basin consisting of a 23'-6" long ramp and a 30-foot long by 12-foot wide stilling basin. The ramp varies in width from 4 feet at the outlet portal of the conduit to 12 feet at the stilling basin. The ramp slopes from elevation 394.5, invert of the conduit to 391.0, the apron elevation of the stilling basin. The end sill has an elevation of 394.5. The guide walls of the structure

extend to elevation 403.5 and connect to the 12-foot long wing walls with the same top elevation. The jump basin walls are provided with 6" v.c. pipe backfill drains. The riprapped exit channel is a 20-foot long trapezoidal section with a 14-foot bottom width and side slopes of 1 on 1-1/2. The protection consists of 24" of riprap on a 6" thick filter blanket.

- (3) Little Dry Creek outlet structure. This structure is located at station 382+20.76 in the Big Dry Creek dam. Details are shown on drawing Nos. SJ-1-114-58, 59, and 60 of Exhibit B-12. The principal features of outlet works include a riprapped inlet channel section, an ogee weir and intake to the gate tower, a gate tower, a control house with access bridge, a concrete conduit through the dam, jump basin and a riprapped exit channel section. The riprapped inlet channel is a trapezoidal section 10 feet in length with a 15-foot bottom width and 1 on 1-1/2 side slopes. The invert grade of the channel is 403.0. The protection consists of a 12" layer of riprap on a filter blanket. A 13-foot long concrete gravity ogee section is provided across the channel at the end of the riprapped section. The crest elevation of the weir is 405.0. Vertical concrete

side walls 17'-6" long extend from the upstream face of the weir to the gate tower. The walls have a top elevation of 411.0 for a distance of 12'-6", then they slope upward to elevation 415.0 at the face of the gate tower. The gate chamber consists of two 4' x 5' openings separated by a 3-foot thick wall. The invert grade is 395.0. The gate chamber section transitions to a 6' x 5' concrete conduit which continues through the embankment section. Two 4' x 5' metal slide gates are provided. They are similar to those installed in the Big Dry Creek outlet works. The gates are manually operated by stem screw hoists located in the control house and a 10" air intake pipe is provided for each gate. Details of the gates and hoists are shown on the drawings contained in Exhibit B-13. The reinforced concrete gate tower extends to elevation 435.0 the top of the dam, and is 7' x 14' (inside dimensions) in plan. A steel grille door, size 3'-6" x 7'-0" is placed in the downstream side of the tower to permit removal of the slide gates for future maintenance work. The control tower, size 9'-6" x 16'-6" x 8'-0" high is constructed of corrugated metal siding in a steel frame similar to the one constructed on the Big Dry Creek outlet structure.

The structural steel access bridge to control house is identical in size and construction as the bridge for the Big Dry Creek outlet structure. The 6' x 5' conduit through the dam is 117'-6" long and is constructed in sections 23'-6" in length. Collars and expansion joints are provided at the section joints. The invert elevation at the outlet portal is 394.0. The 75-foot long jump basin consists of a 42-foot long ramp varying in width from 6 feet at the conduit outlet to 20 feet at the 33-foot long stilling basin. The ramp slopes from elevation 394.0 to elevation 388.0 at the apron of the stilling basin. A 3-foot high terminal sill is provided at the end of the stilling basin. The guide walls of the jump basin have a top elevation of 403.0 and connect with 20-foot long wing walls with the same top elevation. The exit channel section is trapezoidal with a 20-foot bottom width and 1 on 1-1/2 side slopes; the invert elevation is 391.0. The riprap protection is 24" thick and is placed on a 6" filter blanket. The riprap is extended down to the cutoff wall of the stilling basin across the bottom of the channel which makes an overall riprap depth of 7'-6" for a distance of 20 feet downstream from the stilling basin.

(4) Reservoir spillway. The spillway is located in a saddle in the northwest area of the reservoir, station 407+10 of the dam and dike traverse. Details are shown on drawing No. SJ-1-114-55 of Exhibit B-12. This facility includes an approach channel, a control section and an exit channel. The approach channel is an unlined trapezoidal section about 1,200 feet long. The bottom width is 450 feet and the side slopes are 1 on 1-1/2. The invert grade has a 1 percent slope up to a point 100 feet from the upstream face of the concrete control section; from this point to the control section the grade is level at elevation 424.0. The concrete section is 10 feet long. It is a trapezoidal section with a 450-foot bottom width and 1 on 1-1/2 side slopes. The apron grade is set at elevation 425.0, the gross pool elevation of the reservoir. The concrete lined side walls extend to elevation 435.0 which corresponds to the crest elevation of the dam. The lining is 18" thick and reinforced concrete cutoffs walls are provided both upstream and downstream. The upstream cutoff wall is 18" thick and extends 2 feet into the weathered schist while the downstream cutoff is 24" thick and extends a minimum distance of 5 feet below the rock line. A

10-foot long section of channel upstream and a 20-foot long section downstream from the concrete lining is protected with a 24" depth of riprap which increases in depth at the structure in accordance with the distance to the rock line. The abutments of the concrete section consist partly of an earthfill berm, with a 10-foot wide crest width, constructed to elevation 435.0 in order to complete the closure of the natural saddle. These berms are protected, both upstream and downstream, with 24" of riprap on a 6" gravel blanket. The riprap sections are 12' x 70' long and connect with the riprap placed on the excavated channel sections. The exit channel is about 1,100 feet in length and has a minus 6 percent slope. It is a trapezoidal section, identical with the approach channel.

(5) Wasteway in Little Dry Creek outlet channel dike.

The wasteway is located in the Little Dry Creek outlet channel dike at station 86+00. Details of the structure are shown on drawing SJ-1-114-57 (Exhibit B-12). This facility is provided so that if flows in the Little Dry Creek outlet channel should exceed about 700 c.f.s., the excess flow will be wasted over the wasteway into channels leading to Gates Lake, a natural depression that

received runoff from the intercepted area during preproject conditions. The wasteway is a 50-foot wide reinforced concrete structure. It consists of an intake section, a drop structure and stilling basin, and a riprapped apron downstream from the structure. The trapezoidal-shaped intake section extends from the upstream slope of the dike to the center of the dike. It is lined with a 6" concrete slab, reinforced with wire mesh. The apron slab is set at elevation 396.0 and the lined side slopes (1 on 1-1/2) extend to elevation 400.5, the top of the dike. The 6" thick apron slab and 6" thick side slope lining are extended a distance of 3'-6" on the upstream face of the dike along the perimeter of the intake section. The drop structure and stilling basin are formed by 12" thick reinforced concrete walls and slab. A 12" thick breast wall at the center of the dike has a top elevation of 397.34 and connects with the slab of the stilling basin at elevation 390.0. The cutoff wall is 12" thick and extends 3 feet below the apron slab and 3 feet upstream from the vertical drop wall. The vertical side walls of the drop structure and stilling basin are 12" thick and 20 feet long with a top elevation of 401.0 (top of dike) for a distance

of 5 feet; they then slope downward on the same slope as the dike (1 on 2) to the end of the structure. Wing walls 12" thick extend into the embankment section at both ends of the side walls. The wing walls are 9 feet long and 14 feet high at the upstream end and 6 feet long and 8 feet high at the downstream end. The apron slab between the vertical walls is 12" thick and a 18" high baffle wall extends across the apron at a point 11 feet downstream from the breast wall. A 12" thick cutoff wall extends 4 feet below the apron at the end of the basin and connects with the downstream wing walls. A 20-foot long by 64-foot wide area, downstream from the stilling basin, is protected with a 24" minimum thickness of riprap placed on a 6" filter blanket.

(6) Drop structures - Little Dry Creek Outlet Channels.

Five reinforced concrete drop structures are constructed in the Little Dry Creek outlet channel to prevent erosion of the banks of the channel. The structures are identical in construction except structure No. 5 is 1/2 foot longer than the first four structures. Plan details and location of the structures are shown on sheets 1 and 2 of drawing No. SJ-1-9-124 (Exhibit B-12).

The structures are rectangular in shape with side walls extending 20' -2" above the apron slab. The apron is 25' -0" wide, 17'-0" long, except in structure No. 5 where the length is 17'-6", and has a minimum thickness of 12 inches. The apron rests on a 12" minus gravel blanket, and cutoff walls 2'-6" and 3'-0" high are provided at the upstream and downstream end respectively. Uplift under the downstream toe of the apron is relieved by a 6" VC perforated drain pipe which traverses the downstream end of the drop structure. Risers on each end of the drain pipe discharge into the structure immediately upstream of the end sill. Deep holes, 4" in diameter spaced 3'-0" on center, are located in the end sill and provide drainage for the structure. Two 1'-0" x 1'-3" reinforced concrete floor ribs located 6'-0" from the longitudinal centerline of the structure support the apron for its entire length.

Vertical wing walls extend 14'-0" into the embankment at both upstream and downstream end of the structure. The top of the upstream wing walls is at the same elevation at the top of the side walls. At a point 7'-6" downstream from the face of the wing walls the top of the side walls slope

down 9'-4" in a 17'-0" horizontal distance. The top of the downstream wing walls is at the same elevation as the top of the downstream end of the side walls. The lip of the breast walls at the upstream end of the structure is 11'-8" above the invert of the apron. An end sill at the downstream end of the apron is 1'-8" high and provides a drop of 10 feet through the structure.

A safety guard fence consisting of 1 1/4" galvanized pipe posts grouted in concrete and 4 strands of barbed wire is located on top of the side walls and wing walls. A swinging panel as shown on sheet No. 2, Drawing No. SJ-1-4-125 (Exhibit B-12) is suspended above the breast wall by a 1/2" galvanized wire rope.

The upstream approach to the structure is trapezoidal in shape. Beginning at a point 65 feet upstream from the wing walls, the bottom width of the channel increases uniformly to 25 feet in a distance of 50 feet and remains at 25 feet to the entrance to the structure. The side slopes of the channel are 1 on 2 and slope protection for a distance of about 20 feet upstream from the drop structure consists of a concrete stretcher course on an 8" gravel blanket. The downstream channel is also trapezoidal in shape and

the bottom width decreases uniformly from 25 feet at the drop structure to 10 feet at a point 50 feet downstream from the drop structure. The side slopes of the discharge channel are 1 on 1.

Compacted earth dikes extend from both sides of the structures to natural ground, with the top of the dikes 6" below the top of the side walls. The top width of the dike is 7'-0". The upstream slopes of the dikes are 1 on 2 and the downstream slopes conform to the slope of the top of the side walls.

- (7) Side erosion control structures. Beginning at about station 178+00 along Little Dry Creek outlet channel a series of small dikes, seven on the right bank and three on the left, have been constructed to correct lateral erosion of the banks of the outlet channel and adjacent agricultural areas by flows from tributary swales. Plan, location and typical sections of the dikes are shown on sheets 1 and 2 of drawing No. SJ-1-4-125.

The embankments consist of earthfill sections with a top width of 10 feet and varying heights to conform with the topography. The slopes on the stream side of the embankment are 1 on 1.5

and the land side slopes are 1 on 2. Culverts consisting of corrugated metal pipe of the size and gauge shown in the table on sheet 2 of drawing No. SJ-1-4-125 (Exhibit B-12) are placed beneath the embankment on a grade which corresponds to the grade of the eroded ditches. The culverts extend a short distance beyond the stream side toe of the embankment, and a short perforated C.M.P. riser extends vertically to the original ground line at the landward toe of the embankment. A 12 gauge C.M. sheet cutoff wall is placed around the culvert at the centerline of the dike. V-shaped lateral ditches, 1 foot deep with side slopes of 1 on 3 intercept drainage above steep slopes between the dikes and conduct the flow to the upper end of the culverts.

c. Inspection and maintenance.

- (1) Maintenance. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift or debris is not allowed to accumulate near drainage structures. Gates shall be examined, oiled and trial operated at least once every 90 days. Periodic inspections shall be made by the Superintendent to be certain that:

- (a) Pipes, gates, operating mechanism, riprap and headwalls are in good condition;
 - (b) Inlet and outlet channels are open;
 - (c) Care is being exercised to prevent the accumulation of trash and debris near all structures and that no fires are being built near bituminous coated pipes;
 - (d) Erosion is not occurring adjacent to the structures which might endanger its water tightness or stability.
 - (e) Immediate steps are taken to repair damage, replace missing or broken parts, and to remedy adverse conditions disclosed by such inspection.
 - (f) Culverts and lateral ditches are free of debris and side slopes of ditches are in good condition.
 - (g) Guard fences, posts, wires and cables are in good condition. Broken or missing parts shall be immediately repaired or replaced.
- (2) At each inspection required by paragraph 15-g of this manual, the following items, if applicable, shall be particularly noted:
- (a) Damage or settlement of concrete pipe or conduits;

- (b) Condition of slide gate guides, stems and hoists;
 - (c) Condition of concrete cracks, spalls, erosion;
 - (d) Debris or other obstructions to flow;
 - (e) Condition of access bridges to gate towers;
 - (f) Condition of control houses;
 - (g) Condition of embankments adjacent to outlet and drop structures;
 - (h) Condition of riprap stone blanket or protective cover adjacent to outlet or drop structures;
 - (i) Condition of paint on fence posts and gates;
 - (j) Condition of cable clamps;
 - (k) Damage to swinging panel over drop structures;
 - (l) Condition of culverts through dikes;
 - (m) Note any erosion of lateral ditches and culvert outlets.
- (3) All concrete shall be repaired as soon as any reinforcing steel is exposed. The repair shall be made by thoroughly cleaning the surface, by chipping or sand blasting, and building up the concrete to its original section. For this purpose, the use of pneumatically-placed portland cement mortar is considered satisfactory. All evidence of settlement, uplift or failure of concrete structures

shall be referred to the District Engineer for analysis and recommendation of remedial action.

- (4) If the inspection shows the control gates have been jammed, by debris or other obstructions, they shall be thoroughly cleaned so that they operate freely to a full opening or full closure.
- (5) The operating mechanism of the control gates on the three outlet works shall be kept well lubricated. Following is the recommended lubrication for the two types of gate.

(a) Calco gates. (Dog Creek diversion structure)

Hoist gears and stem threads. Apply coating of lime soap base grease blended into heavy oil or other grease which is non-fluid, adhesive and resistant to water, dust and sun. This coating shall be similar and equal to Standard Oil Company Calol multi-service grease No. 4 and shall be applied as needed. The unthreaded portion of stem shall be coated with an adhesive, water resistant, high melting point grease. This grease shall be similar and equal to Standard Oil Company Calol W. P. grease No. 2. A coating of this grease shall be applied to full length of stem below threads. This portion of stem

shall be inspected during low water periods and grease applied when necessary.

(b) Pacific Coast Engineering Company gates.

(Big Dry Creek and Little Dry Creek diversion works)

Hoist gear and bearings. A gear lubricant No. SAE 90, similar and equal to Standard Oil Company RPM gear lubricant shall be applied. Gear housing to underside of worm shaft, shall be filled, drained and refilled once a year.

Stem threads. Sight feed cup shall be filled with mineral oil No. SAE 30, allowing oil to flow during operation of hoist, and keeping valve closed when not in operation.

Unthreaded portion of stem. A coat with an adhesive, water resistant, high melting point grease, similar and equal to Standard Oil Company, Calol W. P. grease No. 2, shall be applied to full length of stem below threads. Inspection shall be made during low water periods and replenish when necessary.

- (6) If any parts of the control gates have been damaged or broken, they shall be replaced by new parts.

New parts for the 48" diameter Calco gates can be obtained from the Armco Steel Corp. in Berkeley, California and new parts for the 4' x 5' slide gates can be obtained from the Pacific Coast Engineering Company, Alameda, California.

- (7) All painted surfaces of the slide gates and their accessories, the structural steel access bridges, the control houses and other miscellaneous metal work in the outlet structures shall be repainted completely every two years. Prior to repainting, all surfaces shall be thoroughly cleaned and the painting shall conform to the requirements for Paints and Painting contained in Section 14 of the Sacramento District office specification No. 1241 for the construction contract.

d. Flood emergency inspection.

- (1) Operation. Whenever high water conditions impend, all gates shall be inspected a short time before water reaches the invert of the pipe, and objects which might prevent closure of the gate shall be removed. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the

embankment. Immediate steps shall be taken to correct any adverse conditions.

- (2) It is understood that the downstream channel capacities of Dog Creek and Big Dry Creek are considerably less than the 250 c.f.s. used as the basis of design. Therefore, the gates of both the Big Dry Creek and Dog Creek diversion works shall be inspected during the early stages of flood flows to make certain the gates are not jammed in an open position which might prevent their regulation and thus permit excessive flows to occur in the downstream channel of Dog Creek and Big Dry Creek.

20. Miscellaneous facilities.

a. Description. Miscellaneous structures or facilities which were constructed as a part of or in conjunction with the major features of the project include the following:

- (1) Recorder gages. In order to maintain a record of releases in Dog Creek, Big Dry Creek and Little Dry Creek and to maintain a record of reservoir stages, recording gage facilities have been constructed near the outlet works for Dog Creek and Big Dry Creek, and on Little Dry Creek approximately three miles downstream from the Little Dry Creek outlet. A Stevens type A35B recorder is installed in a gaging well recorder

house at station 22+30 of the Dog Creek dike. The details of the gaging well, inlet pipes and recorder house are shown on drawing SJ-1-114-87 of Exhibit B-12. The gaging well consists of a 13'-6" diameter, #14 gage, corrugated metal pipe set vertically on a concrete base. The well is set near the upstream toe of the embankment section and 12" thick rock paving, placed on a 6" thick filter blanket, is placed around the well. There are four, 4" diameter, inlet pipes to the gaging well; one each at elevations 479.0, 481.0, 483.0, and 485.0. The two upper pipes are capped and the two lower ones are equipped with strainer nozzles (Clow National #4140). The recorder house is a 6' high, 36" diameter section of corrugated metal pipe with a conical roof and an access door. Access from the Dog Creek dike roadway to the recorder house is provided by a 3'-6" wide wooden bridge. There are two recorder gages with appurtenances at Big Dry Creek outlet works. Location and details are shown on drawings SJ-1-114-61 and SJ-1-114-88 of Exhibit B-12. Both recorders are Stevens type A35B, one for the headwater gage, and the other for the tailwater gage. The headwater recorder is located in the gate control house of the

outlet works. Water stages in the intake channel upstream from the ogee section are obtained via a 10" diameter riser pipe in the gate tower connected to a vertical 36" diameter stilling well with about 50 feet of 36" diameter corrugated metal pipe. The 36" diameter well is located in a conical recess in the right bank of the riprapped intake channel. It is corrugated metal pipe placed on a concrete base and has a removable steel cover. Ladder rungs are bolted on both the inside and outside of the well for access purposes. There are four, 4" diameter intake pipes, one each at elevation 398.5, 401.5, 404.5, and 407.5. The two top pipes are capped and the two lower ones are equipped with Clow National #4140 strainer nozzles. The tailwater recorder is installed in a gaging well and recorder house located adjacent to the left wall of the stilling basin of the Big Dry Creek outlet works. The gaging well is a 14 foot long section of 36" diameter, corrugated metal pipe, set vertically on a concrete base and bolted to the wall of the stilling basin. There are two 4" diameter inlet pipes, one each at elevation 392.0 and 394.0. They are equipped with Clow National #4140 strainers. The recorder house is a 6 foot

high 36" diameter corrugated metal pipe extension to the gaging well. It has a conical roof and a hinged plate 2'-9" x 4'-0" door. At station 161+60 on Little Dry Creek Outlet Channel, a Stevens type A35 recorder is installed in a gaging well recorder house located on the right bank immediately adjacent to a concrete lined section. The gaging well consists of a 14'-6" long, 36" diameter ten gage corrugated metal pipe set vertically on a concrete base. There are two, 2" diameter inlet pipes to the gaging well; one at elevation 387.4 and the other at elevation 386.4. Both inlet pipes are equipped with perforated static tubes. The recorder house is a 6' high, 36" diameter section of corrugated metal pipe with a conical roof and an access door. Access to the recorder house from the roadway is provided by a concrete stairway and a 3' wide steel bridge. An access road has also been provided from an existing farm road (abandoned railroad bed) to the site. The measuring point for this recorder station is located approximately 200' upstream from the recorder house and consists of a cableway across the channel supported by steel "A" frames. A cable

car is suspended on the cable-way. Location and details are shown on drawing SJ-1-9-147 of Exhibit B-12.

- (2) Staff gages. There are thirteen metal staff gages installed throughout the Big Dry Creek project for the purpose of checking releases and flow through the various outlets. The gages are enameled metal and are mounted on structural steel supports. Aluminum numerals are set to permit reading water surface levels in terms of elevations referred to government benchmarks (U.S.G.S.). The details of the gages are shown on drawing SJ-1-114-87 of Exhibit B-12 and their locations are shown on Exhibit B-1. The locations are listed as follows:

<u>No.</u>	<u>Location</u>
1	Recording gage well for Dog Creek.
2	Approach channel to Dog Creek outlet works.
3	Headwall of Dog Creek gate structure.
4	Sidewall of concrete outlet for Dog Creek control and diversion structure.
5	Approach channel to Big Dry Creek outlet works.
6	Backwall of gate tower for Big Dry Creek outlet works.

- 7 Sidewall of stilling basin for Big Dry Creek outlet works.
- 8 Approach channel to Little Dry Creek outlet works.
- 9 Backwall of gate tower for Little Dry Creek outlet works.
- 10 Sidewall of stilling basin for Little Dry Creek outlet works.
- 11 Approach channel to spillway.
- 12 Concrete lined gaging station of Little Dry Creek outlet channel.
- 13 Inlet to wasteway of Little Dry Creek outlet channel dike

- (3) Farm bridge. - A treated timber farm bridge was constructed at station 177+06 of the Little Dry Creek outlet channel. The details are shown on drawing SJ-1-117-115 of Exhibit B-12. The bridge has a 16 foot roadway width and the three spans have a total length of 56 feet. It is designed for a A.A.S.H.O.-H-15 loading, and there is a 13 foot clearance from the bottom of the channel to the bottom stringer of the structure. Approximately 200 foot long approaches, 16 feet wide, connect to an abandoned railroad roadbed.
- (4) Auberry Road Bridge. - A reinforced concrete bridge was built by local interests across Little Dry Creek Outlet Channel on Auberry Road early in 1954, replacing the four pipe culvert installed

under Auberry Road by previous contract.

The structure is located at station 206+72.7 on the Little Dry Creek outlet channel traverse. It consists of two abutments and a center pier with reinforced concrete deck and parapet walls. Each span is 12'-0" clear between abutments and center pier and the low portion of the deck is approximately 7'-0" above the bottom of the outlet channel. The roadway is 32'-6" wide between curbs and the overall length of the deck is 50'-0".

- (5) Embankment road gates. - There are 23 road gates installed across the embankment roadways throughout the project. These 4'-2" x 12'-0" gates are constructed of galvanized tubular steel and are supported by wood posts. The gates are located at the following locations: (See drawings SJ-1-111-91 and 92 in Exhibit B-12).

Station	15+60	Dog Creek dike			
"	33+10	"	"	"	"
"	36+92	Big Dry Creek dike			
"	60+00	"	"	"	"
"	72+50	"	"	"	"
"	80+00	"	"	"	"
"	100+00	"	"	"	"
"	263+85	"	"	"	"

Station	265+10	Big Dry Creek dike			
"	280+50	"	"	"	"
"	288+50	"	"	"	"
"	311+50	"	"	"	"
"	327+60	"	"	"	"
"	348+50	"	"	"	"
"	377+75	"	"	"	"
"	386+50	"	"	"	"
"	35+00	Little Dry Creek outlet channel dike			
"	41+00	"	"	"	"
"	43+00	"	"	"	"
"	59+00	"	"	"	"
"	62+00	"	"	"	"
"	65+00	"	"	"	"

Auberry road about 100 feet NE of bridge.

- (6) Miscellaneous road culverts. - There are two drainage culverts under Shepard Avenue and one under DeWolf Avenue. The Shepard Avenue culverts are 12" diameter corrugated metal pipes about 40 feet long. They are located at the landside toe of Big Dry Creek dike at station 158+00 and station 178+90. The DeWolf Avenue culvert is an 18" diameter corrugated metal pipe about 84 feet in length. It is located within the reservoir area opposite station 263/85 of the Big Dry Creek dam.

b. Inspection and maintenance.

(1) Miscellaneous facilities, maintenance.

Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part thereof, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay.

(2) Inspection of the miscellaneous facilities shall generally be made at the same time that the inspection of the other features of the project are made and shall be reported on indicated check lists shown in Exhibit B-8.

(3) The purpose of maintenance work is to insure continuous satisfactory operation of the facilities. It is therefore, important that all possible causes of future trouble be found and corrected. Additional inspection and maintenance measures, more particularly applicable to each type of facility are given in the following:

(a) Gages.

1. In addition to the regular inspection required by paragraph 15-g(2) the

automatic recording gages shall be inspected at least once in each seven-day period during the flood season (1 November to 30 April). Particular attention shall be given to the following items:

- a. Check that clock is running and re-wind if necessary.
 - b. Check that pen is marking and refill ink reservoir if necessary.
 - c. Check that paper is feeding smoothly through instrument and replace feed roll as necessary.
 - d. Check operation of float by turning float wheel back and forth.
 - e. Read outside and inside gages and note readings and day and hour of inspection on chart.
 - f. Check functioning of inlets to stilling well and clean if necessary.
 - g. Check accumulation of silt in stilling well and clean if necessary.
2. At the time of each regular inspection the following shall be noted:
- a. Damage or settlement of stilling wells.
 - b. Condition of riprap around stilling wells.

- c. Condition of wood access bridge at Dog Creek gaging station.
- d. Condition of recorder houses.
- e. Condition of staff gages - any slippage or displacement.

3. Each automatic recording gage shall be cleaned, lubricated according to manufacturer's instructions, and overhauled, if necessary, at least once a year, preferably during the month of October, immediately prior to the flood season. Each staff gage shall be cleaned of adhering mud or stain which would interfere with their legibility as often as required. The access bridge at the Dog Creek gage shall be kept in good repair and repainted as necessary. Any adverse condition disclosed by the inspections shall be corrected immediately and all the gaging facilities kept in the best possible condition.

(b) Farm bridge.

1. At the time of each regular inspection of the bridge, attention shall be given to the following:

- a. Accumulation of debris under bridge;
- b. Erosion or underscouring action adjacent to concrete foundations;
- c. Condition of bents and other supporting members;
- d. Condition of decking and side rails;
- e. Condition of concrete footings; development of cracks and spalls.
- f. Deviation from grade settlement or upheaval;
- g. Condition of painted surfaces.

2. Any adverse condition disclosed by the inspections shall be corrected immediately and the entire facility maintained in the best possible condition. All painted areas shall be repainted as necessary to insure maximum serviceability of the structure. All painting shall conform to the requirements contained in section 14, Paints and painting of the contract specifications. (District office spec. No. 1241).

(c) Auberry Road Bridge.

- 1. At the time of each regular inspection of the facility the following items shall be particularly noted:

- a. Presence of debris or other obstruction to flow;
- b. Damage or settlement of headwalls;
- c. Condition of concrete - cracks, spalls, erosion;
- d. Condition of riprap;
- e. Condition of roadway;
- f. Condition of access to farm road and rifle range road.

2. It is imperative that the structure be kept open and unobstructed at all times. All accumulation of trash and debris in or adjacent to the bridge shall be removed. All debris or aggradation in the approach channel and outlet channel shall be removed. Any other adverse conditions found upon inspection shall be promptly corrected.

- (d) Embankment roadway gates. - If upon inspection it is found that the tubular steel gates or wood posts have been damaged or broken they shall immediately be repaired, and maintained in good operating condition. If any gates are locked, the keys shall be kept readily available by the Superintendent at the project site, to permit ready passage through such gates of all authorized travel.

- (e) Miscellaneous road culverts. - If inspections show the presence of silt or debris which is restricting flow in these culverts it shall be removed. Any other adverse conditions found upon inspection shall be promptly corrected.

c. Flood emergency inspection.

- (1) Operation. - Miscellaneous facilities shall be maintained to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor.
- (2) The Stevens type A35B, recording gages shall be kept in operation during the flood season. For operation and maintenance of this recorder refer to bulletin No. 12 of the Leupold and Stevens Instruments, 4445 Neglisan St., Portland 13, Oregon.
- (3) The only other pertinent operating requirements are for the farm bridge and Auberry road crossing. During periods of floods the Superintendent shall make certain that the bridges are kept free of floating debris which might lodge against them and reduce the waterway capacity.

21. Suggested Methods of Combating Flood Conditions

a. General. The methods described herein have been developed during experience with the various problems that often arise during periods of high water. The procedures are not intended to restrict the Superintendent, or others concerned, or to establish a rigid set of rules for every condition that may arise. If problems arise, where the Superintendent is in doubt as to the procedure to be taken, he will be expected to consult the District Engineer, U. S. Engineer Office, Sacramento, California.

b. Earthfill embankments. An earthfill embankment is in danger whenever there is water against it. This danger is directly proportional to the height of the water, the duration of the flood stage, and the intensity of either the current or wave action. A well constructed embankment of proper section, if maintained and not overtopped, should hold throughout any major flood. Foundation troubles may result in sand boils or a sinking embankment, and the local use of unsatisfactory materials causes slides and sloughs. Wave wash is to be expected whenever the embankment is exposed to a wide stretch of open water and is serious if permitted to continue over a considerable length of time.

c. Security. Personnel of the Corps of Engineers, whether military or civilian, are not vested with any civil police authority in the performance of their engineering duties, and they will not attempt to exercise any such authority. The responsibility for protecting flood control works against sabotage, acts of depredation,

or other unlawful acts rests with the local interests through local and state governmental agencies.

d. Preliminary work. The County of Fresno, through their Superintendent, shall form a skeleton organization, capable of quick expansion, and assign individuals (sector foreman) to have charge of definite sections of the project in accordance with the provisions of paragraph 15a of this manual. Immediately prior to the flood season, the Superintendent should:

(1) Ascertain that all roads to the embankments are in good state of repair.

(2) Locate necessary tools and materials (sacks, sandbags, brush, lumber, lights, etc.) and store these materials at strategic points.

(3) Check the location of all telephone lines and equipment necessary for emergency operation.

Upon receipt of information that high water is imminent the organization shall be alerted and the foremen called to duty. Each sector foreman shall recruit a labor crew and provide it with required tools and materials, then go over his entire sector and parts of adjacent sectors to note:

(4) Sector limits; ascertain that the dividing line between sectors is plainly determined and, if necessary, marked.

(5) Conditions of embankments.

(6) Conditions of culverts and gates.

(7) Material supply; quantity, locations and conditions.

(8) Communications; locate and check all necessary telephones in the sector.

e. Flood fighting. The methods of combating various defects in earthfill embankments described in the following paragraphs have been proved effective. The foundation conditions and the construction methods used on the Big Dry Creek Project are such that there should be very low percolation both through embankment section and the underlying foundation. If, however, seepage areas or sand boils do develop, they can be successfully combated by these methods.

(1) Drainage of slopes. Seepage drains should be cut at all places on the earthfill section and berm when seepage appears. The drains should be V-shaped, no deeper than necessary, and never more than 6" deep. Care must be taken not to cut the sod unnecessarily. In all instances, drains should be cut straight down the slope or nearly so. Near the toe of the slope the small drains should be Y'd together and led into larger drains, which, in general, should lead straight across the landside berm into the landside pits or nearest natural or artificial drain.

(2) Sandboils. The common method of controlling sand boils consists of walling up a watertight sack ring around the boil up to a height necessary to reduce the velocity of flow to a point at which material is no longer discharged from the boil. See Exhibit B-5-1. The sack ring around the boil should be large enough to protect the defective area immediately surrounding the boil. If several boils of sufficient force to displace the sand

are observed a sack sublevee may be built around the entire nest of boils, rising to such a height that none of the boils will discharge with enough force to displace sand.

(3) Wave wash. The Superintendent and sector foremen shall study the embankment beforehand to determine the possibility of wave wash. Sections of cotton bagging shall be placed over the washed areas, as shown on Exhibit B-5-3. As an alternative, filled sacks shall be placed in the cut in an effective manner and as soon as possible. The filled sacks shall be laid in sections of sufficient length to give protection well above the anticipated rise. Bagging so laid must be thoroughly weighted down to be effective. Exhibit B-5-2 shows a movable type of wave wash protection, also used with good results. Its advantage is that it can rapidly be built at any convenient place and easily set in place on the job.

(4) Scours. A careful observation shall be made of the waterside of the embankments at all localities where a current is observed. Trouble may be looked for at the ends of dikes, road-crossing ramps, old traverses, and places where structures penetrate the embankment. If any sign of scour is observed, soundings shall be taken to observe the amount and progress of the scour. Scour can be checked by constructing deflection dikes using brush, treetops, or lumber, driving stakes and wiring together, and filling in between with brush and filled sacks or stone.

(5) Caving bank protection. Rock-filled cribs are very effective if properly placed. Cribs are usually 14 feet by 14 feet in plan by 10 to 14 inches in inside depth. The cribs are

constructed on a double thickness of 1" x 4" x 14' lumber, equivalent to 2" x 4" pieces, lapped rail fence fashion at all corners and intersections. They are divided into four compartments of about equal area by two perpendicular cross walls constructed in the same manner as the side walls. The floors and covers are built up of double 1" x 4" boards spaced about 9" center-to-center. Under the floor and perpendicular to the direction of the floor boards are five equally spaced pairs of 1" x 4" boards about 3 feet center-to-center. On top of the cover, perpendicular to the direction of the cover boards, are three pairs of top boards, one over each of the side walls and one over the central division wall. All intersections are nailed with one 20d nail. The compartments are filled with rock before covering. Each wall intersection of the fabricated cribs is securely fasten by a loop of No. 9 wire. See Exhibit B-5-4.

f. Topping. Immediate consideration shall be given the grade line of each embankment section by comparison of existing grades with those shown on the drawings, Exhibit B-12. If any reaches show a grade below the previous highest water, emergency topping shall be undertaken at once to such a grade as may be established by the District Engineer, U. S. Engineer Office, Sacramento, California, as follows:

(1) Sack topping. Sack topping may be used to raise the crown of the embankment about three feet. The sacks shall be laid stretcherwise or along the crown for the first layer, crosswise for the second layer, and so on. Sacks shall be lapped at least $1/3$ either way and well mauled into place. When properly

sacked and tamped, one sack will give about three to four inches of topping. If gravel is available, it shall be used for the front facing so as to avoid washing out.

(2) Lumber and sack topping. This is the most commonly used method of raising low reaches in emergencies. In putting on this topping, as well as other topping, a careful line of levels shall be run and grade stakes set in advance. 2" x 4" x 6' stakes shall then be driven on the upstream side of the crown six feet apart, and 1" x 12" boards nailed to the landside of the stakes. This wall, backed with a single tier of sacks, will hold out at least one foot of water. If a second foot is necessary, the layers of sacks will have to be increased in number and reinforced. The stakes shall be driven three feet in the ground, projecting out three feet, thus providing, in extreme cases, a three-foot topping if properly braced behind with sacks and earth. In some instances, it may be practicable to back up the planking with tamped earth obtained in the vicinity in lieu of the sacks.

g. Transportation. In instances where it is necessary to send equipment over roads that are impassable due to mud or sand, their passage may be provided by the use of a plank road or by means of steel or wire mats. Telephone communication shall be provided along dangerous stretches of the embankment when travel or other satisfactory means of communication cannot be maintained.

h. Use of government plant. The District Engineer is authorized to use or loan government property and plant in cases of emergency where life is in danger and there is no opportunity to

secure prior authority for such use. The authority also extends to saving of property where no suitable private equipment is available, provided that such use is without detriment to the Government.

22. Accident Prevention.

a. Scope. It is not the intent of this section to provide information on all phases of accident prevention and safety which may be applicable to the operation and maintenance of this facility. Safety is considered adequately covered in the manual "Safety Requirements," issued by the Chief of Engineers. Certain procedures and practices which should receive special attention from the standpoint of safety are mentioned herein.

b. Guidance. Operating personnel should become familiar with the contents of the manual "Safety Requirements" and have a copy on hand.

c. Services and Safety Devices. Several employees should be qualified to administer first-aid treatment at the site of operations. The location of first-aid equipment and other life saving devices should be made known to all employees, and the name, location, and telephone number of the nearest hospital and doctor should be posted. Arrangements should be made with the nearest fire department equipped with a resuscitator for help in the event of an emergency.

d. Flammable and Toxic Liquids. Highly flammable or toxic liquids should not be used for cleaning machinery, equipment or for other such purposes. A recognized cleaning solvent as refined by the major oil companies should be used.

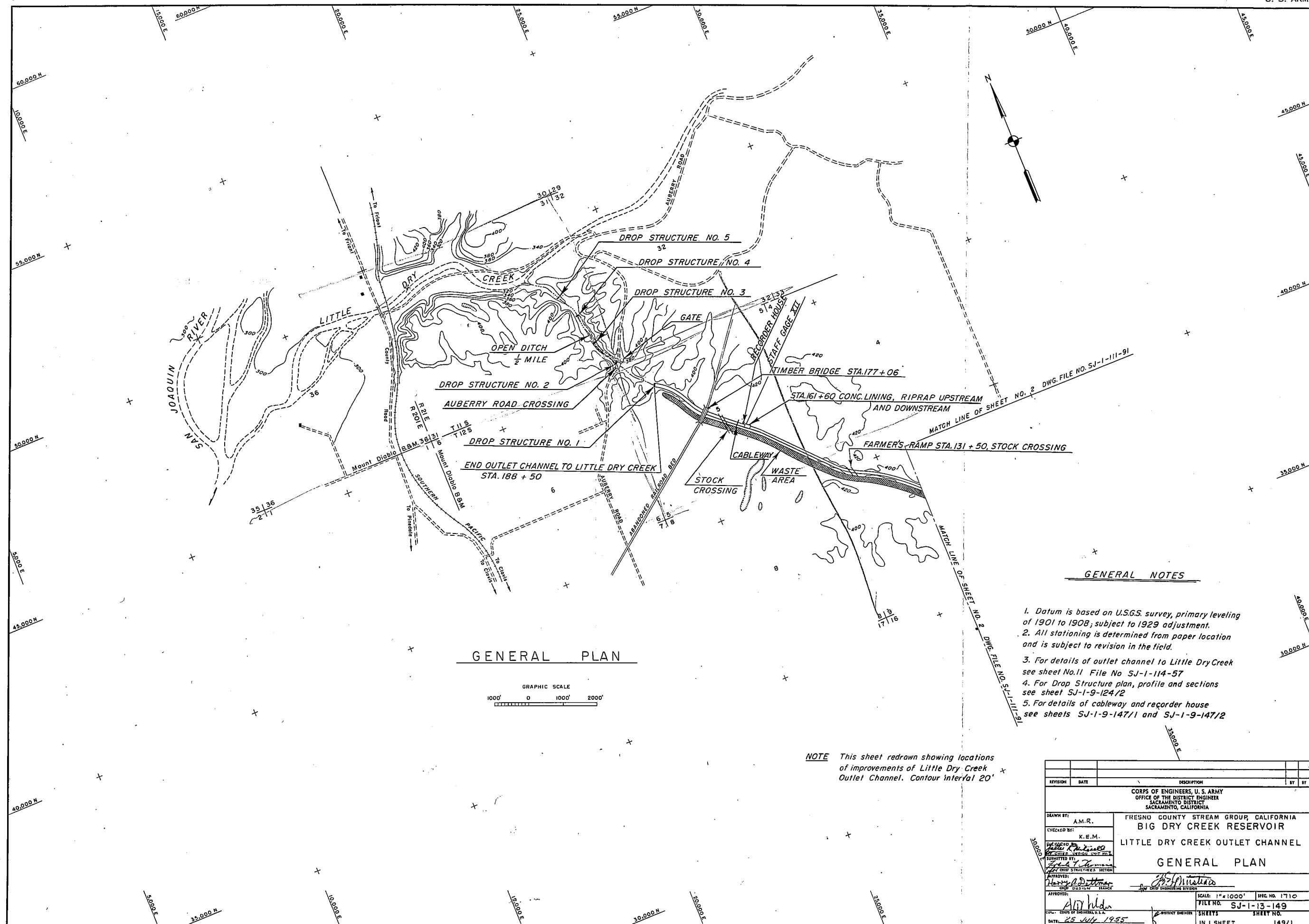
e. Paints and Vehicles. Packages containing paints, varnishes, lacquers, thinners, or other volatile painting materials should be kept tightly closed when not in actual use, and should be stored in a well ventilated location free from excessive heat, sparks, flame, or the direct rays of the sun.

f. Fire Protection. Fire extinguishers should be inspected monthly and the date recorded on the inspection tag attached thereto.

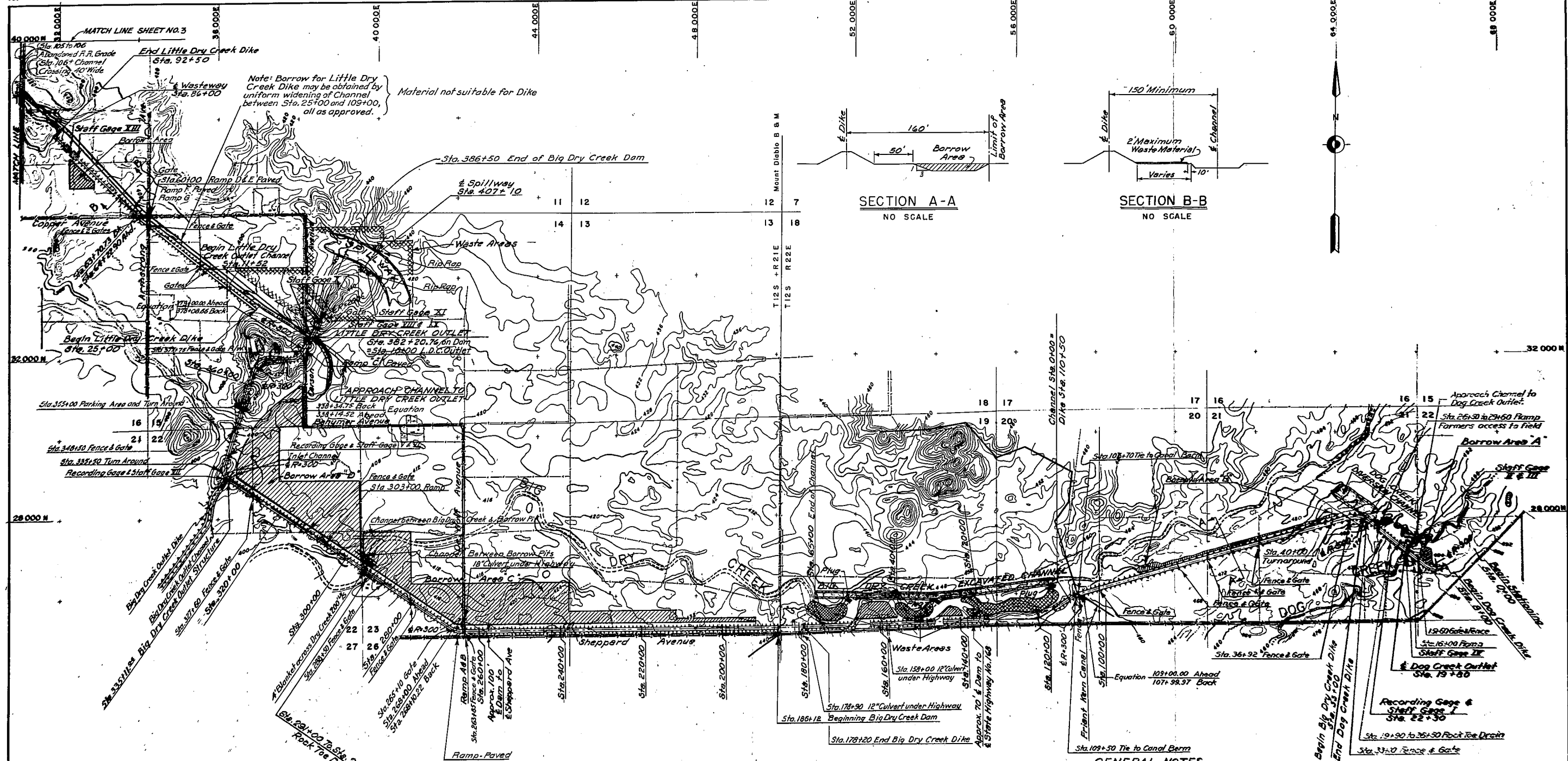
g. Tools. Hand and portable power tools assigned to the work should be kept in good repair and used only for the purpose for which designed.

h. Hazardous Work Locations. Inspection and maintenance duties should not be performed by lone personnel in the conduits, lower levels of the control tower or gage houses, or in other hazardous locations.

i. Visitors. Adequate procedures should be established for the safe handling of the visiting public.



REVISION	DATE	DESCRIPTION	BY	BT
<p align="center">CORPS OF ENGINEERS, U. S. ARMY OFFICE OF THE DISTRICT ENGINEER SACRAMENTO DISTRICT SACRAMENTO, CALIFORNIA</p>				
DRAWN BY: A.M.R.		FRESNO COUNTY STREAM GROUP, CALIFORNIA		
CHECKED BY: K.E.M.		BIG DRY CREEK RESERVOIR		
DESIGNED BY: J.E.M.		LITTLE DRY CREEK OUTLET CHANNEL		
SUBMITTED BY: J.E.M.		GENERAL PLAN		
APPROVED: [Signature]		[Signature]		
APPROVED: [Signature]		[Signature]		
DATE: 25 JUL 1955		SCALE: 1"=1000' SPEC. NO. 171C		
		FILE NO. SJ-1-13-149		
		SHEET NO. 149/1		



SECTION A-A
NO SCALE

SECTION B-B
NO SCALE

GENERAL NOTES

Datum is based on U.S.G.S. survey, primary leveling of 1901 to 1908; subject to 1929 adjustment. Locations of structures are approximate and may be adjusted in the field to suit conditions. For details of Spillway see sheet No. 9. For details of Outlet Channel & Dike to Little Dry Creek see sheet No. 11. For details of Little Dry Creek Outlet Structure see sheet No. 12. For details of Big Dry Creek Outlet Structure see sheet No. 15. For details of Dog Creek Outlet Structure see sheet No. 18. For Gate details see sheets No. 24 and 25. For Ramp & Access Road details see sheet No. 26. Payment for all borrow shown on this sheet will be made at contract price item ⑦. Payment for all excavation shown on this sheet will be made at contract price item ⑥.

ROAD SURFACE - GRADED AGGREGATE

Dog Creek Dike Sta. 8+00 to 33+00
Big Dry Creek Dike Sta. 33+00 to 107+70
Big Dry Creek Dam Sta. 263 to Carson Ave.
Ramp De Wolf and Sheppard Ave.
Ramp Sta. 26+30 Dog Creek Dike
Ramp Sta. 303 Big Dry Creek Dam
Ramp Carson Ave. and Little Dry Cr. Str.
Little Dry Creek Dike Sta. 25+00 to 35+75
Ramp Copper and Armstrong Avenues

23- Single Drive 12' Farm Gates
Berms on Paved Ramps (Slope protection)

AS CONSTRUCTED

This drawing supersedes drawing No. SJ-1-M-49

FRESNO COUNTY STREAM GROUP, CALIFORNIA

BIG DRY CREEK RESERVOIR

GENERAL PLAN

GRAPHIC SCALE
1"=200'

U.S. ENGINEER OFFICE, SACRAMENTO, CALIFORNIA

DESIGNED: [Signature] RECOMMENDED: [Signature]

SUBMITTED: [Signature] APPROVED: [Signature]

DR. BY [Signature] TR. BY [Signature] CH. BY [Signature]

NO. REVISION DATE BY APVD.

2 As Constructed 3/29/48 P.S.

1 Earthwork Tables removed. Alignment, Borrow area Waste Areas revised. 2/14/47 W.M.F. J.L.H.

EXHIBIT E-1 Sheet 2

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

Chapter II—Corps of Engineers, War Department

PART 208—FLOOD CONTROL REGULATIONS MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1936, as amended and supplemented (49 Stat. 1571; 50 Stat. 877; and 55 Stat. 638; 33 U. S. C. 701c; 701c-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

§ 208.10 *Local flood protection works; maintenance and operation of structures and facilities*—(a) *General*. (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) *Levees*—(1) *Maintenance*. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken; such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of

the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) *Operation*. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) *Flood walls*—(1) *Maintenance*. Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) *Operation*. Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) *Drainage structures*—(1) *Maintenance*. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) *Closure structures—(1) Maintenance.* Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order;

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given

in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants—(1) Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines; fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied, all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways—(1) Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities—(1) Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Regs. 9 August 1944, CE SPEWF)

[SEAL]

J. A. ULIO,
Major General,
The Adjutant General.

[F. R. Doc. 4a-12285; Filed, August 16, 1944;
9:44 a. m.]

Sheet 2 of 2

EXHIBIT B-2-2

EXHIBIT B-3

PERMIT

(Name of Levee Commission or City)

(Location)

Permission is hereby granted to:

(Name of Firm or Individual)

(Address)

TO: (Describe in these spaces the proposal, including kind and type of construction, purpose intended, location by stationing. Indicate passageway provided by means of gates, etc. Use separate sheets if necessary, identifying each by reference herein.)

Provided That:

Upon termination or expiration of this permit (whether by voluntary relinquishment by the grantee, by revocation by the grantor or otherwise) the grantee shall remove all structures, improvements, or appurtenances which may have been erected or constructed under this permit, and shall repair or replace any portion of the flood protection structure or right-of-way which may have been damaged by his operations (including grading and seeding, or sodding, if necessary), to the satisfaction of the grantor.

The structure or operation for which this permit is issued shall be maintained by the grantee in such manner as shall not injure or damage the flood protection structure, or interfere with its operation and maintenance in accordance with regulations of the Secretary of the Army.

The structure or operation covered by this permit may be damaged, removed or destroyed by the grantor in time of flood emergency if such action is determined by the grantor to be necessary in order to preserve life or property or prevent damage or impairment to the use or safety of the flood protection structure, and the grantor shall not be liable to the grantee for such damage or destruction.

Unless otherwise specifically provided herein, this permit may be cancelled at any time by the grantor upon 10 days written notice mailed to the address shown above. During such 10 day period, (or such other period as may be provided herein), the grantee will be permitted to remove any property or improvements installed under this permit, and to repair or replace any damage to the flood protection right-of-way or structures resulting from his use or operations. At the end of such period, the grantor shall have the right to possess and dispose of any such property or improvements remaining upon its right-of-way, and may proceed to repair or replace any such damage, and the grantee herein shall be liable to the grantor for the full cost of such repairs or replacements.

Signature (Grantee)

(Date)

(Date)

District Engineer

FRESNO COUNTY STREAM GROUP
FLOOD CONTROL PROJECT

AGREEMENT OF ASSURANCE TO THE SECRETARY OF WAR

WHEREAS, The Congress of the United States, by Public Law No. 228, 77th Congress, First Session, approved August 18, 1941, did authorize the construction of that certain Flood Control Project known and designated as the Fresno County Stream Group, in the State of California, and did also require that the State, political subdivisions thereof, or other responsible agencies give assurances satisfactory to the Secretary of War that they will (a) provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the project; (b) hold and save the United States free from claims for damages due to the construction of the works and their subsequent operation and maintenance; and (c) bear the expense of bridge construction and maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of War; and

WHEREAS, the State of California, by Chapter 1514, of the Session Laws of the Regular Session of the Legislature of 1945, approved on July 19, 1945, did authorize and empower its Reclamation Board to give such assurances, on behalf of the State of California, to the Secretary of War, as required by the above mentioned Acts of Congress; and

WHEREAS, the State of California by Chapter 142 of the Extra Session of the Legislature of 1946, approved March 12, 1946 did appropriate the funds required for the cost of all lands, easements, and rights-of-way required for the construction of said Fresno County Stream Group Project;

NOW, THEREFORE, The Reclamation Board of the State of California, duly created by law, does hereby, on behalf and in the name of the State of California, give assurances to the Secretary of War that the State of California will (a) provide without cost to the United States all lands, easements and rights-of-way necessary for the construction of the project; (b) hold and save the United States free from claims for damages due to the construction of the works and their subsequent operation and maintenance; and (c) bear the expense of bridge construction and maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of War.

IN WITNESS WHEREOF, The Reclamation Board of the State of California, has caused this instrument to be executed by its President and Secretary, this 11th day of March 1947, at Sacramento, California.

THE RECLAMATION BOARD OF THE
STATE OF CALIFORNIA

BY A. R. Galloway Jr., President

BY George H. Holmes, Secretary

EXHIBIT B-4-1

R E S O L U T I O N

PASSED AND ADOPTED BY THE RECLAMATION BOARD

APRIL 7, 1948

- - - - -

WHEREAS The Reclamation Board has heretofore approved the plans and specifications for the Big Dry Creek Reservoir and Diversion Project which is also designated as the Fresno County Stream Group Project as set out in Act of Congress approved August 18, 1941, Public Law 228, 77th Congress, 1st Session; and

WHEREAS the Department of the Army, Corps of Engineers, District Engineer, Sacramento District, did on March 19, 1948, notify the Reclamation Board that said Big Dry Creek Reservoir and Diversion Project has been completed as of February 27, 1948, and did by said notification transfer to the State of California said project for its operation and maintenance; and

WHEREAS The Chief Engineer and General Manager of said Board had caused an inspection of said project works to be made and has found same to be full and complete pursuant to the plans and specifications therefor; and

WHEREAS in accordance with law said Board has entered into a contract and agreement with the County of Fresno, dated August 6, 1946 and properly executed by the Board of Supervisors of said County, which contract and agreement provides that said County of Fresno will upon completion thereof take over, operate and maintain said project in accordance with requirements prescribed by the Secretary of War, and will assume the obligation of holding and saving the United States free from claims for damages due to construction works and their subsequent operation and maintenance, and to further hold the State of California and The Reclamation Board harmless from any claim therefor; now therefore be it

RESOLVED AND ORDERED that the Reclamation Board does hereby accept for the State of California, in accordance with provisions of Chapter 1514 of the Statutes of 1945 and of Chapter 142 of the Statutes of 1946, the Big Dry Creek Reservoir and Diversion Project for maintenance and operation in furtherance of the resolution of assurances heretofore furnished the Secretary of War; and be it

FURTHER RESOLVED AND ORDERED that the said Project be, and the same is hereby turned over to the County of Fresno for maintenance and operation in accordance with the contract and agreement heretofore made with said County.

EXHIBIT B-4-2

STATE OF CALIFORNIA)
COUNTY OF SACRAMENTO) SS
Office of the Reclamation Board)

I, S. A. HONAKER, Assistant Secretary of the Reclamation Board, do hereby certify that the above and foregoing is a true and correct copy of a Resolution passed and adopted by said Board as its meeting held April 7, 1948.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of The Reclamation Board, this 14th day of April 1948.

/s/ S. A. Honaker
S. A. HONAKER
Assistant Secretary

THIS AGREEMENT is made between the Reclamation Board of the State of California and the County of Fresno on the 6th day of August, 1946, in view of the following circumstances:

BY act of Congress approved August 18, 1941, in Public Law No. 228, 77th Congress, First Session, construction by the United States of the flood control project for the Fresno Stream Group was approved and authorized as set forth in House Document 845, 76th Congress, Third Session.

The State of California, by Chapter 1514 of the Statutes of 1945, adopted and authorized said project for flood control of the Fresno County Stream Group and authorized acquisition by the Reclamation Board of lands and rights-of-way required for said project at State expense.

The State of California, by Chapter 142, Statutes of 1946, Extraordinary Session, has appropriated money for the payment of the costs of acquiring all lands, easements and rights-of-way necessary for the construction of said project, requiring, however, as a condition precedent to the allocation of any State funds to the Reclamation Board that a local public agency other than the Reclamation Board has either assumed the obligations of maintenance and holding the United States harmless from damages due to the construction works directly with the United States or has by binding agreement with the Reclamation Board agreed to assume such obligations and to hold the State and the Reclamation Board harmless from any claims therefor.

Congress has appropriated funds for the Federal construction of said project so that the construction thereof will be accomplished without cost to the County of Fresno or to any of the area benefited by said works; and

The Reclamation Board will give the United States the necessary assurance as to maintenance and holding the United States harmless from damage due to the construction works upon the receipt of a binding agreement by the County of Fresno that said county will assume said obligations and will hold the State and the Reclamation Board harmless from any claims therefor.

Said project is beneficial to lands and properties in the County of Fresno as it will result in the protection of such lands and properties from floods in the areas downstream from the proposed flood control works.

IT IS THEREFORE AGREED:

I.

The Reclamation Board upon receiving an allocation of the necessary funds will acquire without cost to the County of Fresno all lands, easements and rights-of-way necessary for the construction of said flood control project.

EXHIBIT B-4-4

II.

The County of Fresno does hereby assume the obligation of holding and saving the United States free from claims for damages due to the construction works and their subsequent operation and maintenance, bearing the cost of bridge construction on county roads, and operation and maintenance of all works for completion in accordance with the requirements prescribed by the Secretary of War, and further agrees to hold the State of California and the Reclamation Board harmless from any claims therefor.

IN WITNESS WHEREOF, the parties hereto have executed this agreement on the date above-mentioned.

THE RECLAMATION BOARD

BY /s/ A. R. Gallaway, Jr.
President

BY /s/ S. A. Honaker
Assistant Secretary

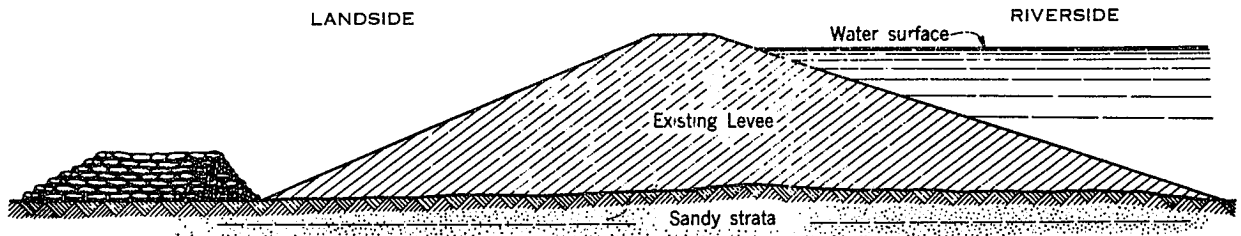
COUNTY OF FRESNO

BY /s/ C. Todd Clark

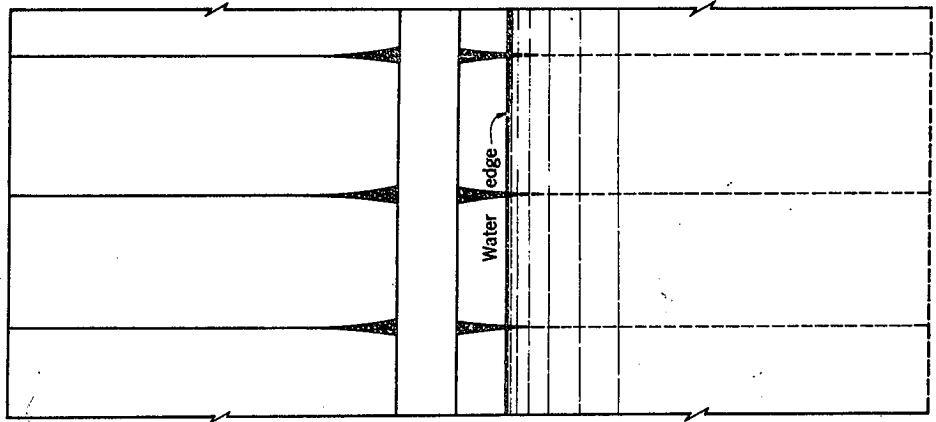
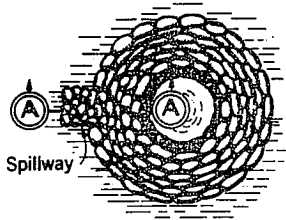
BY E. Dusenberry, Clerk

BY Geo. M. Fumeaux
Deputy Clerk

(SEAL)

**Note:**

Bottom width to be no less than $1\frac{1}{2}$ times height.
Be sure to clear sand discharge.
Tie into levee if boil is near toe.

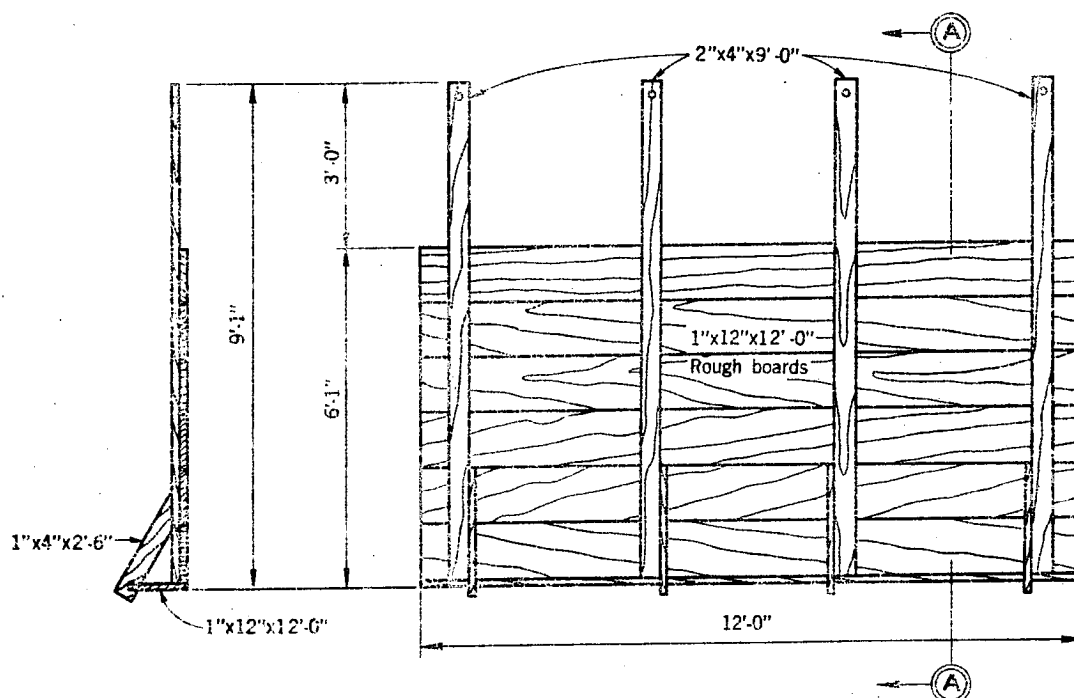
ELEVATION**SECTION A-A****PLAN****Note:**

Do not sack boil which does not put out material.
Height of sack loop or ring should be only sufficient to create enough head to slow down flow through boil so that no more material is displaced and boil runs clear.
Never attempt to completely stop flow through boil.

SACRAMENTO RIVER , CALIFORNIA
FLOOD CONTROL PROJECT

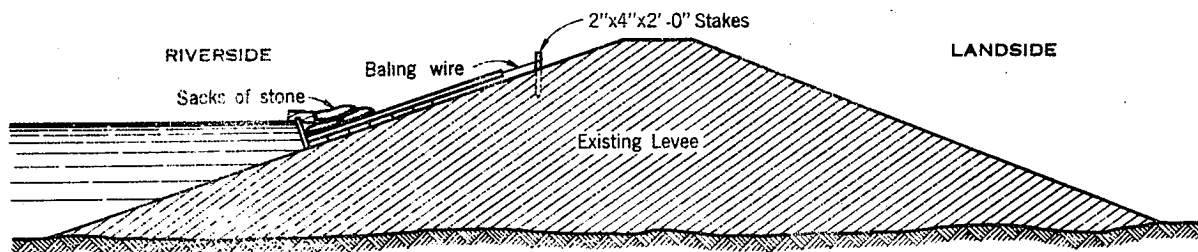
CONTROL OF SAND BOILS

U.S. ENGINEER OFFICE , SACRAMENTO, CALIF.
MAY, 1946



SECTION A-A

PLAN



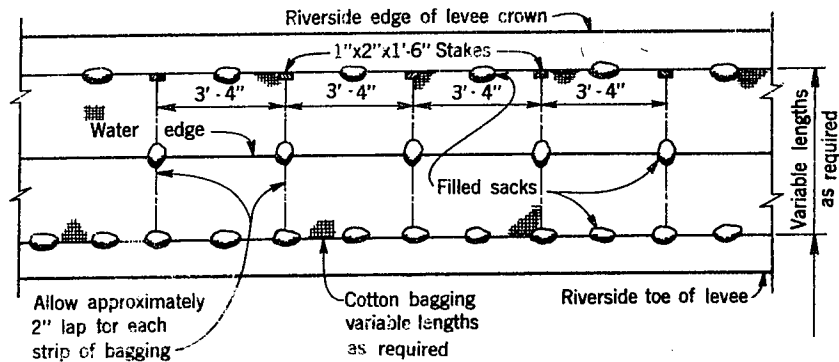
SECTION

BILL OF MATERIAL FOR 100 FEET	
LUMBER	
56 pieces	1"x12"x12'-0"
32 pieces	1"x4"x2'-6"
32 pieces	2"x4"x9'-0"
* 32 pieces	2"x4"x2'-0"
* (Sharpened)	
WIRE	
200'	baling wire
NAILS	
4½ lbs.-8d	nails

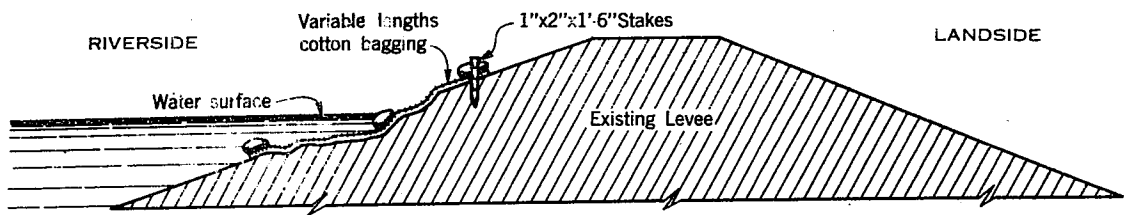
SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

**MOVABLE
WAVE WASH PROTECTION**

U.S. ENGINEER OFFICE, SACRAMENTO, CALIF.
MAY, 1946



PLAN



SECTION

Note:

Lay lengths as required of cotton bagging approximately parallel with levee slope and across damaged section. Weight top and edges of bagging with filled sacks as shown above. The filled sacks should be wired or tied to each strip before laying in place. Stake the corners of each strip above water surface. Where cotton bagging is not available burlap sacking may be substituted.

MATERIAL REQUIRED FOR 100
LINEAR FEET OF LEVEE

LUMBER

- * 30 Stakes 1"x2"x1'-6"
- * (Sharpened)

SANDBAGS

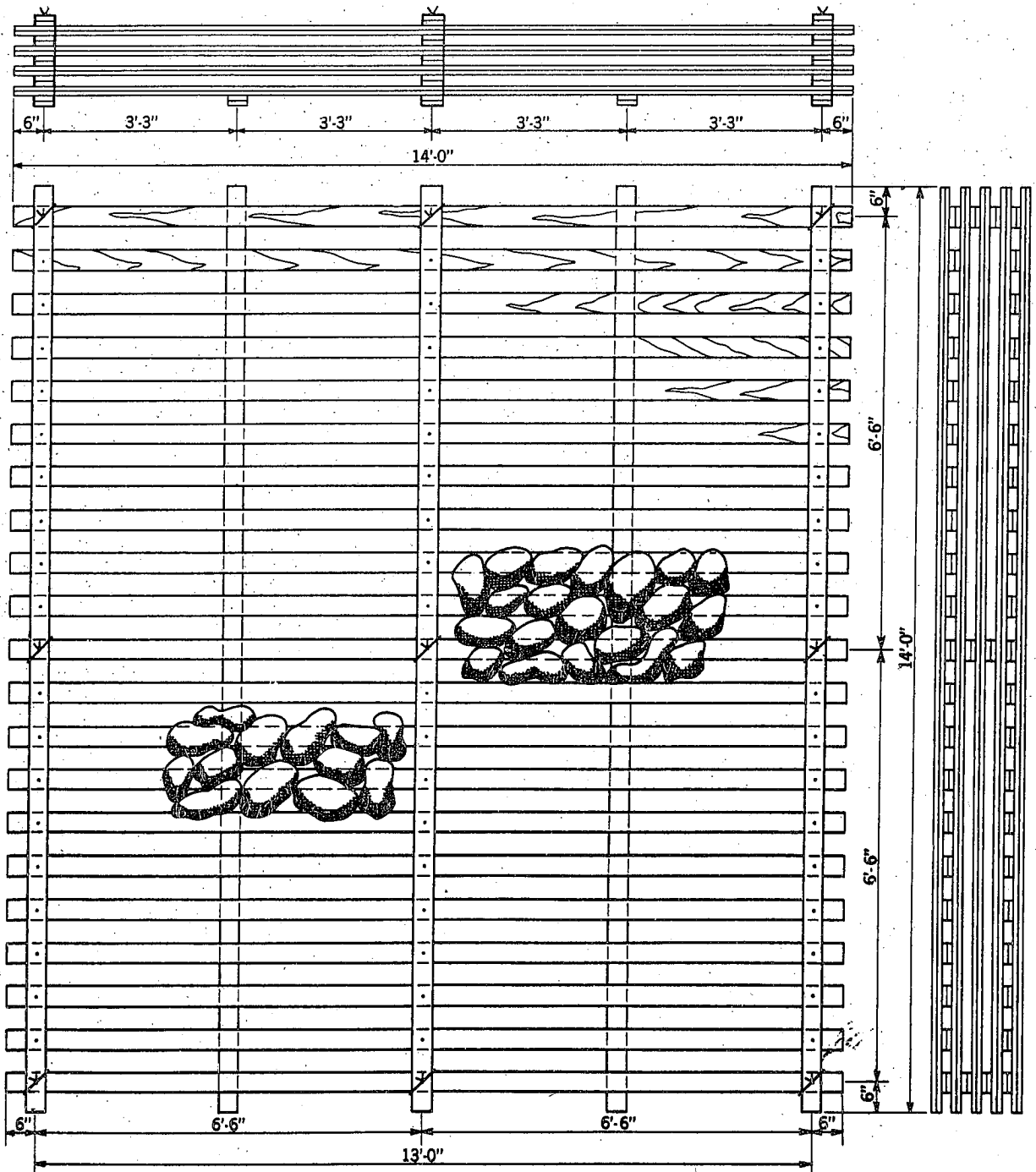
120 sand bags
Cotton bagging
as required

SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT

WAVE WASH PROTECTION

U.S. ENGINEER OFFICE, SACRAMENTO, CALIF.

MAY, 1946

**Note:**

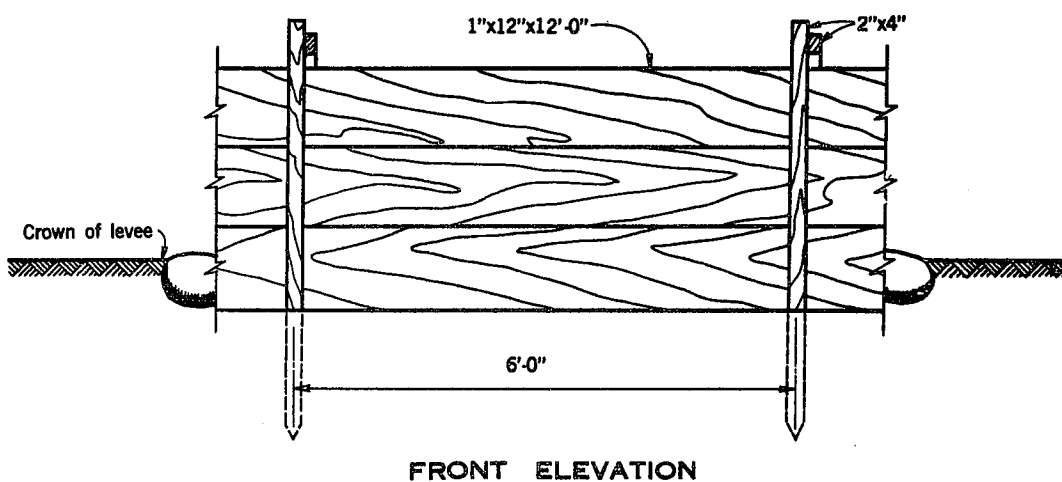
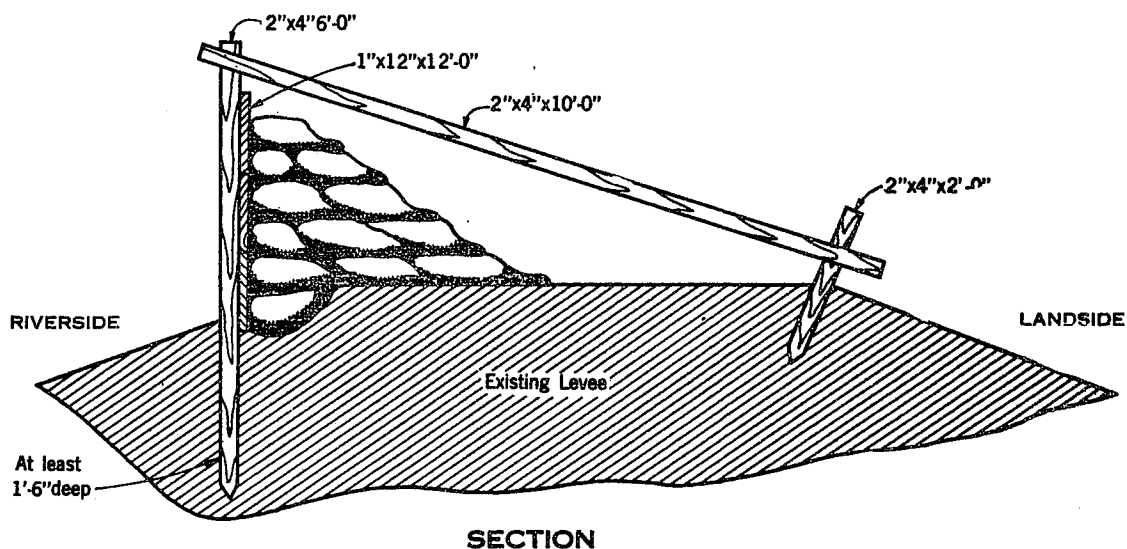
Cribs constructed of double thickness of 1"x4"x14'-0" lumber. Nail all intersections with 1-20d nail. Each intersection of walls securely fastened by a loop of No. 9 wire, tightly twisted.

BILL OF MATERIAL FOR ONE CRIB 13'-0"	
LUMBER	
130 pieces 1"x4"x14'-0"	
WIRE	
30' No. 9 wire	
NAILS	
12½ lbs. 20d nails	

**SACRAMENTO RIVER, CALIFORNIA
FLOOD CONTROL PROJECT**

CAVING BANK PROTECTION

U. S. ENGINEER OFFICE, SACRAMENTO, CALIF.
MAY, 1946



BILL OF MATERIAL FOR 100 LINEAR FEET OF LEVEE	
LUMBER	
25 pieces 1"x12"x12'-0"	
17 pieces 2"x4"x10'-0"	
* 17 pieces 2"x4"x6'-0"	
* 17 pieces 2"x4"x2'-0"	
* (Sharpened)	
NAILS	
1 lb. -8d nails	
2 lbs. -16d nails	
SANDBAGS	
1100 bags	

SACRAMENTO RIVER, CALIFORNIA FLOOD CONTROL PROJECT

LUMBER AND SACK TOPPING

U. S. ENGINEER OFFICE, SACRAMENTO, CALIF.
MAY, 1946

(1 May 19 ____)
(1 Nov 19 ____)

To: The District Engineer
Sacramento District
Corps of Engineers
1208 - 8th Street
Sacramento, California

Dear Sir:

The semi-annual report for the period (1 May 19 ____ to 31 Oct 19 ____) (1 Nov 19 ____ to 30 April 19 ____) on the project, Big Dry Creek Reservoir and Diversion, Fresno County, California, is as follows:

a. The physical condition of the protective works is indicated by the inspection reports, copies of which are inclosed, and may be summarized as follows:

(Superintendent's summary of conditions)

It is our intention to perform the following maintenance work in order to repair or correct the conditions indicated:

(Outline of anticipated maintenance operations for the following 6 months)

b. During this report period, major high water periods (reservoir level at elevation 414.0 or higher) occurred on the following dates:

<u>Date</u>	<u>Max. Elevation</u>
_____	_____
_____	_____
_____	_____

Comments on the behavior of the protective works during such high water periods are as follows:

(Superintendent's log of flood observations)

During the high reservoir stage when the reservoir reached elevation 425.0 or in excess thereof (dates) _____ it was necessary to organize and carry on flood operations as follows:

(See Maintenance Manual, paragraph 4-02 d (2))

c. The inspections have indicated (no) or (the following) encroachment or trespasses upon the project right-of-way.

Action or prosecution for abatement of these encroachments or trespasses are summarized as follows: (or state none have been necessary).

d. (No) () permits have been issued for (the following) improvements or construction within the project right-of-way.

Executed copies of the permit documents issued are transmitted for your files.

e. The status of maintenance measures, indicated in the previous semi-annual report as being required or as suggested by the representatives of the District Engineer, is as follows:

(Statement of maintenance operations, item by item with percent completion)

f. The fiscal statement of the Superintendent's operations for the current report period is as follows:

	Labor	Material	Equip.	Overhead	Total
1. Inspection					
2. Maintenance Operations					
3. Flood-fighting Operations					
Total					

Respectfully submitted,

Superintendent of Works

District Engineer.
Sacramento District
Corps of Engineers, US Army
P. O. Box 1739
Sacramento 8, California

Dear Sir:

Pursuant to the requirements of paragraph 15a(2) of the Maintenance Manual for Big Dry Creek Reservoir and Diversion, California, the following names and telephone numbers of personnel responsible for the operation of the Big Dry Creek Reservoir and Diversion Project are furnished:

<u>Name</u>	<u>Office</u>	<u>Home</u>
-------------	---------------	-------------

Telephone Number

Very truly yours,

Project Superintendent

Annual Report on Emergency Personnel
EXHIBIT B-7

CHECK LIST NO. 1
DAM AND DIKE EMBANKMENTS

Inspector's Report Sheet No. _____ Date _____

<u>Item</u>	<u>Remarks</u>
(a) Name of dike & location by station	:
(b) Settlement, sloughing or loss of grade	:
(c) Condition of riprap protection	:
(d) Condition of sod cover	:
(e) Condition of roadways including ramps	:
(f) Evidence of seepage	:
(g) Condition of toe drains	:
(h) Condition of drainage road culverts	:
(i) Condition of farm gates & fencing	:
(j) Maintenance measures taken since last inspection	:
(k) Comments	:

Inspector

Superintendent

Instructions for completing Sheet 1, Exhibit B-8
(To be printed on back of Sheet 1)

- Item (a) Indicate name of dam or dike and show station of observation obtained by pacing from nearest reference point.
- Item (b) If sufficient settlement of earth work has taken place to be noticeable by visual observation, indicate amount of settlement in tenths of a foot. If sloughing has caused a change in slope of the embankment sections, determine new slope. Note areas where erosion or gullyng of the section has occurred.
- Item (c) State any change that has taken place in the riprap such as disintegration of rock, erosion or slide ing of rock down the face. Indicate size and character of vegetation thar may have grown up through the riprap. Note the presence of any drift or debris.
- Item (d) Note condition of seeded areas and indicate if there has been inappropriate burning of grass or unauthorized grazing.
- Item (e) Note any material change in grade and section of roadway and ramps. Indicate any inadequacy in surface drainage system.
- Item (f) Indicate any evidence of seepage through the embankment sections particularly around the toe drains.
- Item (g) Indicate if downstream toe drains are functioning and if silt is decreasing their efficiency.
- Item (h) Note if the two - 12" dia. drainage culverts under Sheppard Avenue and the 18" culvert under DeWolf Avenue have excessive accumulations of sediment, rubbish, and vegetal matter.
- Item (i) Indicate the serviceability of all farm gates across the embankment roadway and indicate if repainting is required. Note any damage to posts, fencing and barbed wire.
- Item (j) Indicate maintenance measures that have been performed since last inspection and their condition at time of this inspection.
- Item (k) Record opinion, if any, of contributory causes for conditions observed, and also any observations not covered under other columns.

NOTE: One copy of the Inspector's Report is to be mailed to the District Engineer immediately on completion, and one copy is to be attached to and submitted with the Superintendent's semi-annual report.

CHECK LIST NO. 2
CHANNELS AND RESERVOIRS

Inspector's Report Sheet No. _____ Date _____

<u>Item</u>	<u>Remarks</u>
(a) Name of channel & location by station	:
(b) Vegetal growth in channel	:
(c) Debris & refuse in channel or reservoir	:
(d) New construction within rights of way	:
(e) Extent of aggradation or degradation	:
(f) Condition of staff gages	:
(g) Condition of riprapped section	:
(h) Condition of concrete lined section	:
(i) Condition of road crossings	:
(j) Condition of bridges	:
(k) Condition of earthfill plugs	:
(l) Measures taken since last inspection	:
(m) Comments	:

Inspector

Superintendent

EXHIBIT B-8
Sheet 3 of 6

Instructions for completing Sheet 3, Exhibit B-8
(To be printed on back of Sheet 3)

- Item (a) Indicate name of channel and show station of observation obtained by pacing from nearest reference point.
- Item (b) Note nature, extent, and size of vegetal growth within the limits of the flood flow channel.
- Item (c) Note nature and extent of debris and refuse that might cause clogging of the conduits of the outlet works, the road culverts or bridge.
- Item (d) Report any construction along the channel or in the reservoir area that has come to the attention of the inspector and that might affect the functioning of the project.
- Item (e) Indicate any changes in the grade or alignment of the channels, either deposition of sediments or scour, that is noticeable by visual inspection. Estimate amount and extent.
- Item (f) Note any damage that may have occurred to the staff gages since the last inspection.
- Item (g) Indicate any change that has taken place in the riprap such as disintegration of the rock, erosion or movement of the rock. Note the presence of vegetal growth through the riprap.
- Item (h) Record condition of concrete lining with particular attention given to settlement cracks, spalls, abrasive wear and condition of construction joints.
- Item (i) Indicate amount of debris and other obstructions to flow; note any settlement of conduits and state the condition of concrete headwalls.
- Item (j) Note any damage or settlement of the concrete footings. Indicate condition of wooden structures and if repainting is required. Indicate condition of bridge approaches.
- Item (k) Indicate if there is any sloughing, settlement or excessive seepage of the earthfill plugs along Big Dry Creek excavated channel.
- Item (l) Indicate maintenance measures that have been performed since the last inspection and their condition at time of this inspection.
- Item (m) Record opinion, if any, of contributory causes for conditions observed, and also any observations not covered under other columns.

NOTE: One copy of the Inspector's report is to be mailed to the District Engineer immediately on completion and one copy is to be attached to and submitted with the Superintendent's semi-annual report.

CHECK LIST NO. 3
OUTLET WORKS AND RECORDER STATIONS

Inspector's Report Sheet No. _____ Date _____

(a) Name of structure and location	:
(b) Debris or obstructions to flow	:
(c) Damage or settlement of conduits or structures	:
(d) Condition of concrete	:
(f) Condition of control gates & accessories	:
(g) Condition of access bridges	:
(h) Condition of gaging facilities	:
(i) Condition of electric service & layout	:
(j) Corrective action taken since last inspection	:
(k) Comments	:

Inspector

Superintendent

Instructions for completing Sheet 5, Exhibit B-8
(To be printed on back of Sheet 5)

- Item (a) Indicate name of structure and enter centerline station.
This sheet is intended for use during inspections of the 3 control and diversion structures, the spillway, the Little Dry Creek Outlet Channel Wasteway and the gage recording stations.
- Item (b) Inspect the conduits and their intake and outlet structures for accumulations of sediment, rubbish and vegetal matter.
- Item (c) Record any settlement of the conduits or of the spillway and wasteway structures.
- Item (d) Indicate condition of concrete and record any evidence of cracks, pop-outs, spalls and abrasive wear. Note condition of expansion joints.
- Item (e) Note condition of riprap and indicate any change such as disintegration of the rock, erosion or movement and any presence of vegetal growth through the riprap.
- Item (f) Note condition of control gates in respect to: freedom of movement in guides, condition of seals, condition of supports, lubrication, operating condition of hoist and gate position indicator. Indicate any evidence of rust and condition of paint for gate and accessories.
- Item (g) Note condition of the access bridges, particularly the bolted connections and indicate any necessity for repainting.
- Item (h) Note condition of gaging facilities in respect to: serviceability of inlet pipes and strainers for the stilling well, any settlement of concrete base, all bolted connections, functioning of automatic recorder and float system, any accumulation of silt in the stilling well.
- Item (i) Indicate maintenance measures that have been performed since the last inspection and their condition at the time of this inspection.
- Item (j) Record opinion, if any, of contributory causes for conditions observed, and also any observations not covered under other columns.

NOTE: One copy of the Inspector's Report is to be mailed to the District Engineer immediately on completion and one copy is to be attached to and submitted with the Superintendent's semi-annual report.

BIG DRY CREEK RESERVOIR

List of "As Constructed" construction drawings

1. Locality	SJ-1-110-48
2. General Plan	SJ-1-111-91
3. General Plan	SJ-1-111-92
4. Hydrographs and Rainfall Data	SJ-1-113-51
5. Location of Exploration Holes	SJ-1-112-84
6. Logs of Foundation Holes	SJ-1-112-85
7. Logs of Borrow Exploration Holes	SJ-1-112-86
8. Profiles and Sections	SJ-1-112-54
9. Spillway - Plan and Sections	55

Outlet Channel to Little Dry Creek

10. Plan and Sections	SJ-1-114-57
-----------------------	-------------

Little Dry Creek Outlet Structure

11. Plan and Sections	58
12. Reinforcing Details No. 1	59
13. Reinforcing Details No. 2	60

Big Dry Creek Outlet Structure

14. Plan and Sections	61
15. Reinforcing Details No. 1	62
16. Reinforcing Details No. 2	63

Dog Creek Outlet Structure

17. Plan and Sections	64
18. Reinforcing Details	65
19. Miscellaneous Details No. 1	66
20. Miscellaneous Details No. 2	67
21. 4x5 Service Gate Assembly	SJ-1-115-68
22. Electrical Layout	SJ-1-116-69
23. Gage Details No. 1	SJ-1-114-87
24. Gage Details No. 2	88
25. Ramp and Access Road Details	SJ-1-117-71
26. Farm Bridge - Plan and Details	115
27. Rock Toe Drain Revised Cross Section	117
28. Auberry Road Crossing	118
29. Ramps D, E, F, G	119

Outlet Channel to Little Dry Creek

30. Drop Structures	SJ-1-9-124/1.1
31. Drop Structure No. 4	124/2.1

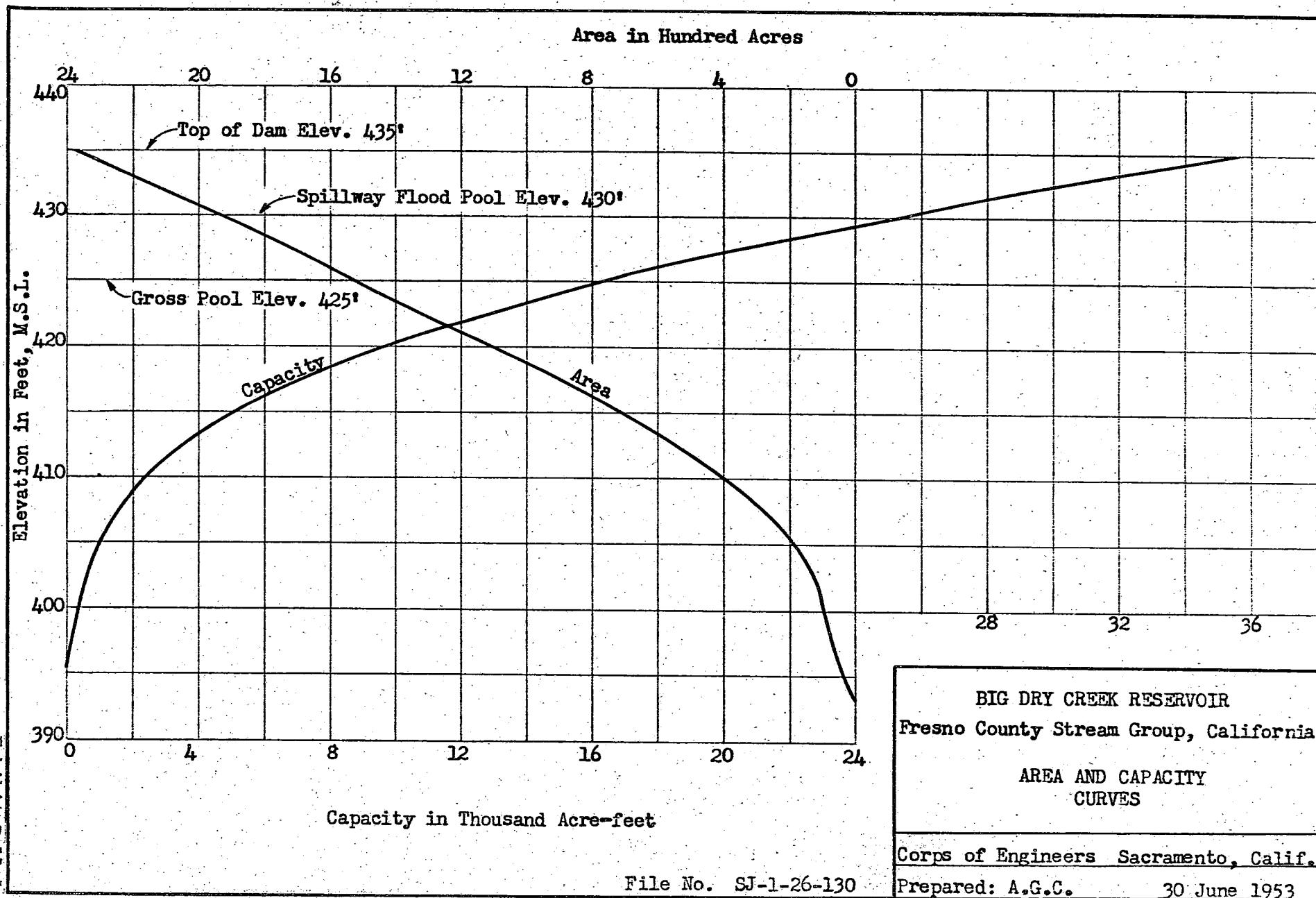
Side Erosion Control Structure

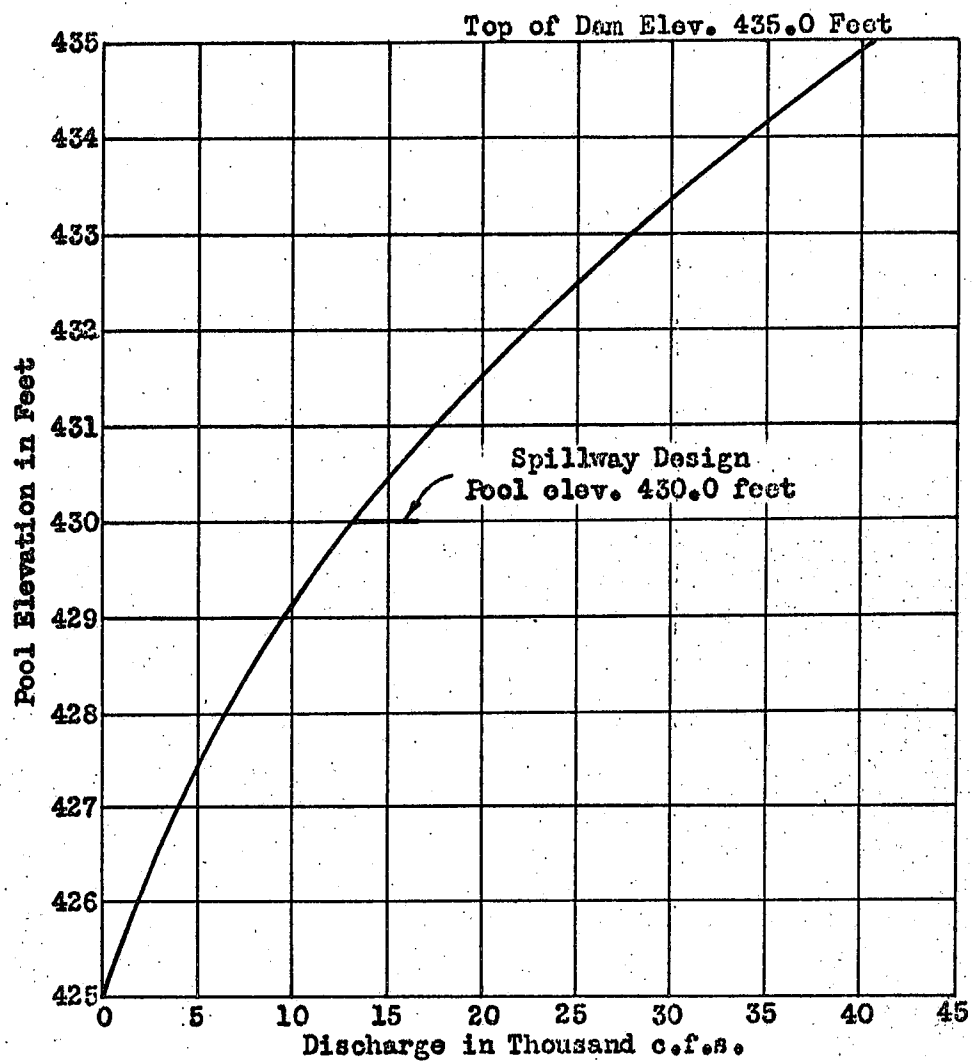
32. General Plan and Locality Map	SJ-1-4-125/1.2
33. Plans Sections and Details	125/2.2
34. Cableway, Access Road	SJ-1-9-147/1.2
35. Gage House and Well	147/2.2
36. Rehabilitation of Drop Structures 3, 4, and 5	SJ-1-4-151/1

BIG DRY CREEK RESERVOIR

List of drawings for service gates

4' x 5' Service Gate	SJ-1-27-90
Assembly	Sheet 1
Gate Frame	Sheet 2
Gate Frame Extension and Accessories	Sheet 3
Gate Leaf Guide and Accessories	Sheet 4
Guide Base Plate and Bearing Strip	Sheet 5
Top Seal	Sheet 6
Gate Leaf	Sheet 7
Leaf Bearing Strip and Eye Bolt	Sheet 8
Steam and Vent Pipe	Sheet 9
Stem Guide	Sheet 10
Hoist	Sheet 11
Allowances and Tolerances for Metal Fits	Sheet 12





BIG DRY CREEK RESERVOIR
Fresno County Stream Group, Calif.

SPILLWAY RATING CURVE

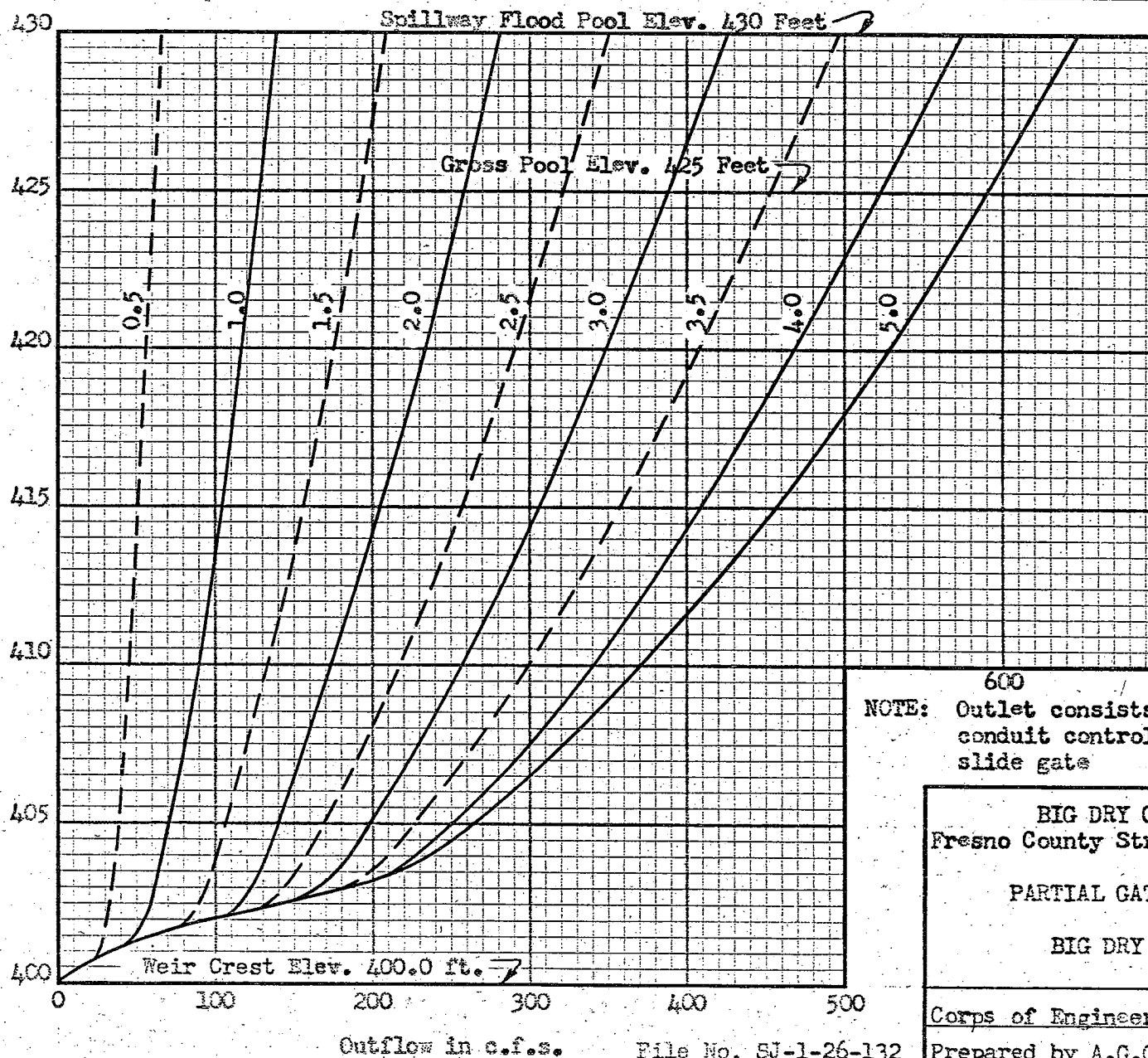
Corps of Engineers, Sacramento, Calif.

Prepared: A.G.C. Date: 9 April 1953

File No. SJ-1-26-137

Exhibit B-11-2

Pool Elevation in Feet m.s.l.



Revised 1 July 1954

600
NOTE: Outlet consists of one 4'-0" x 5'-0" conduit controlled by 4'-0" x 5'-0" slide gate

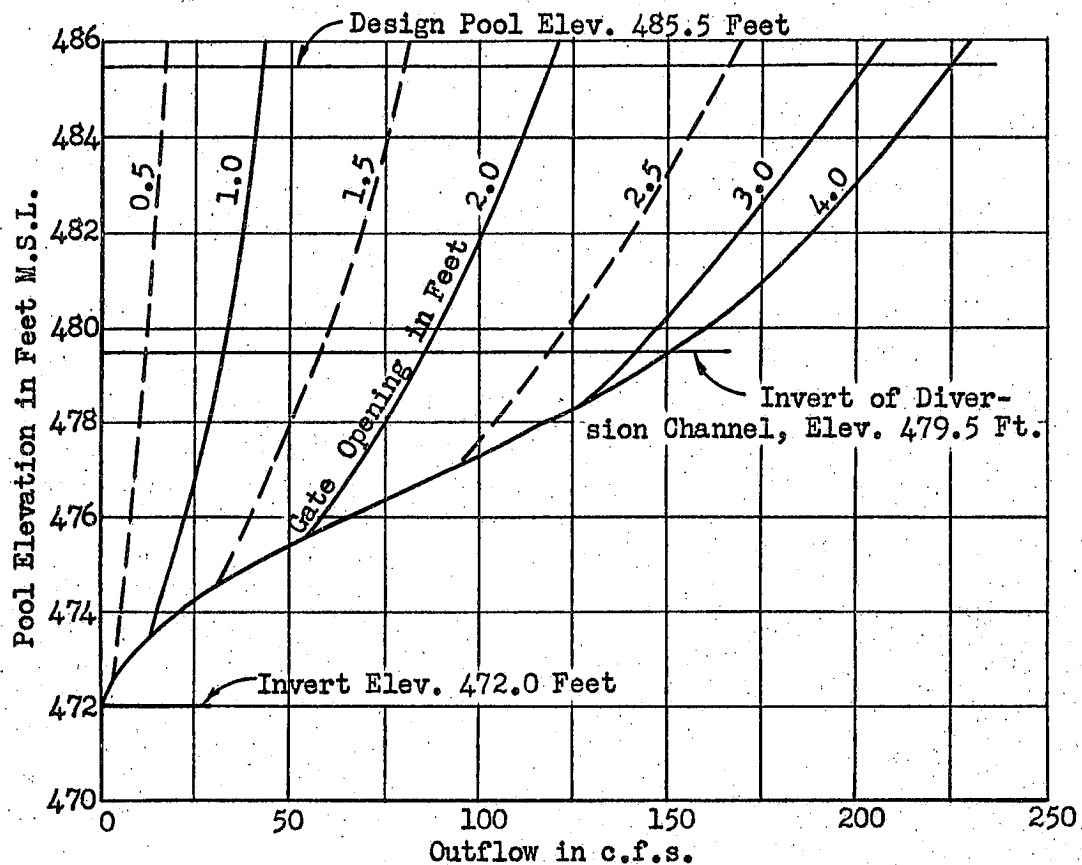
BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California

PARTIAL GATE OPENING CURVES

BIG DRY CREEK OUTLET

Corps of Engineers Sacramento, Calif.

Prepared by A.G.C. 9 April 1953



NOTE: Outlet consists of two 48"-dia. conduits controlled by slide gates.

BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California

PARTIAL GATE OPENING CURVES
DOG CREEK OUTLET

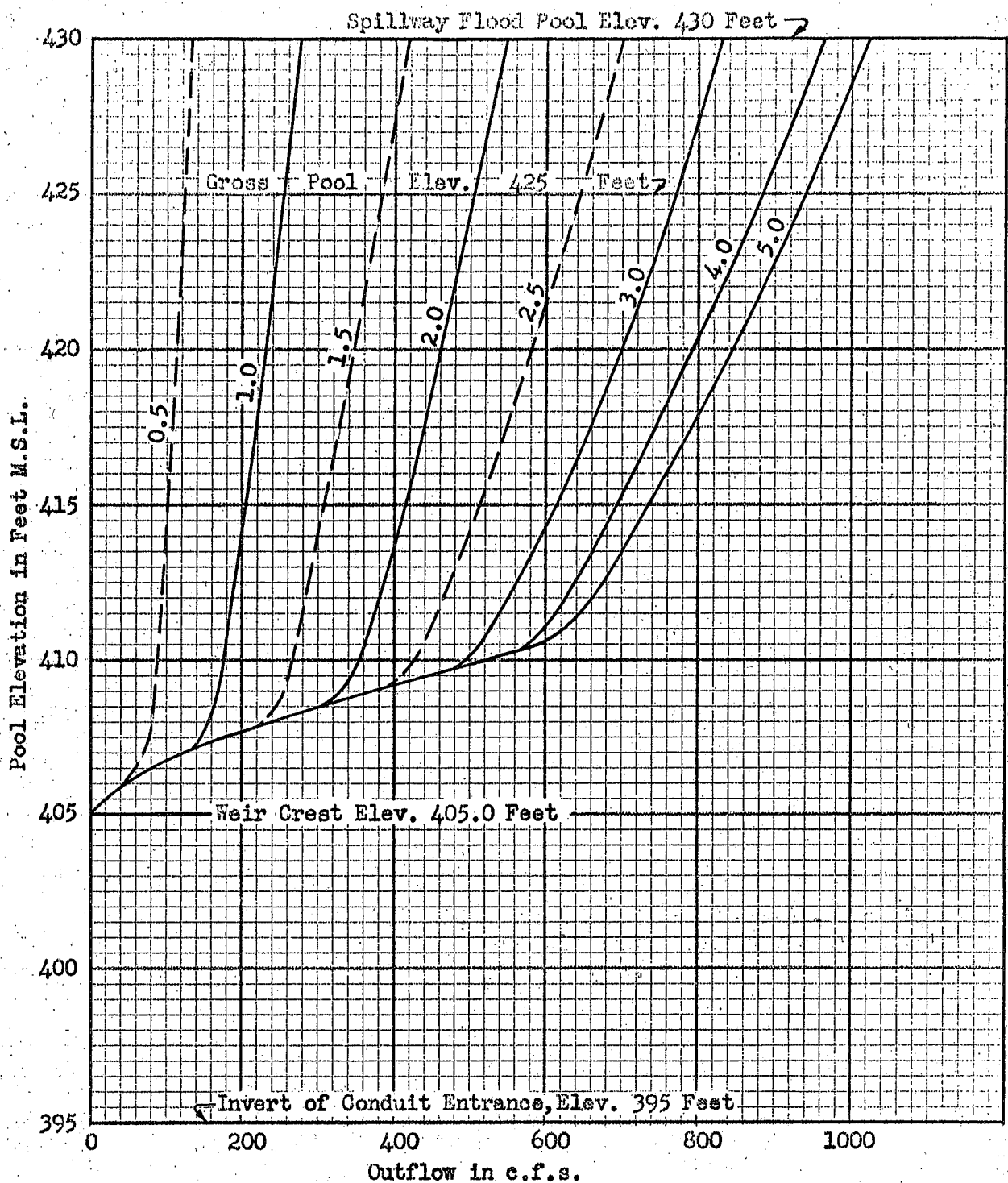
Flow Through Each Conduit

Revised 1 July 1954
File No. SJ-1-26-138

Corps of Engineers Sacramento, Calif.

Prepared by A.G.C. 9 April 1953

Exhibit B-11-1



NOTE:

Outlet consists of one 6'-0" x 5'0" conduit controlled by two 4'0" x 5'0" slide gates.

BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California

PARTIAL GATE OPENING CURVES
LITTLE DRY CREEK OUTLET
TWO GATES OPERATING SIMULTANEOUSLY
(Identical openings)

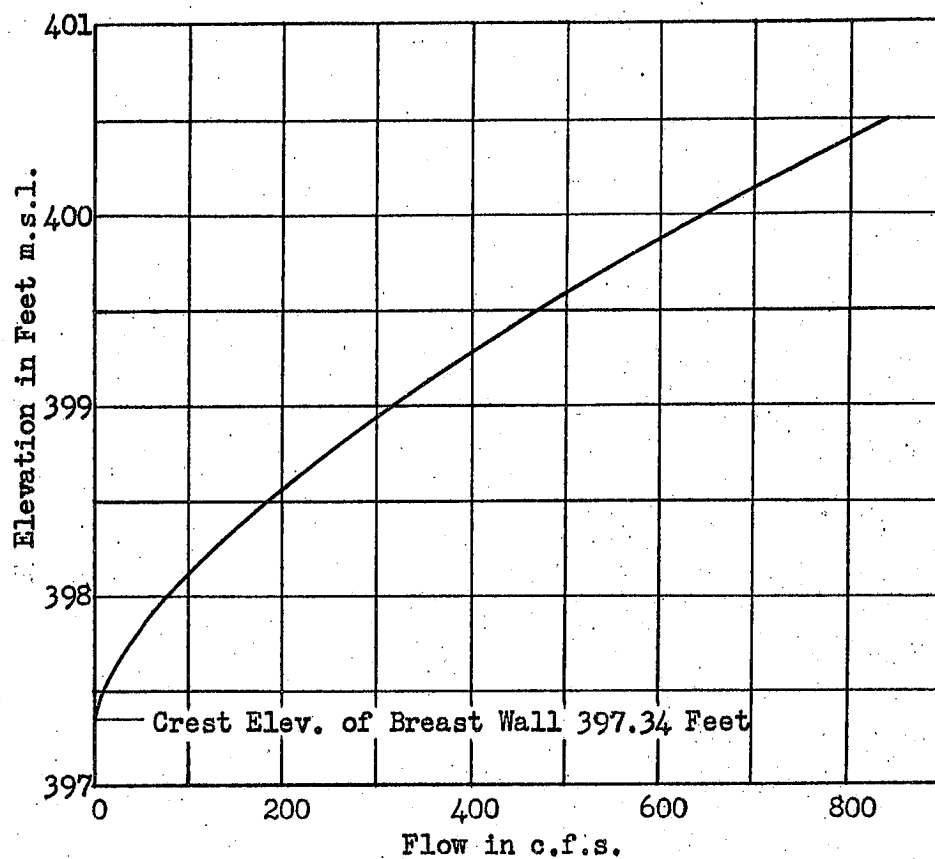
Corps of Engineers Sacramento, Calif.

Prepared by A.G.C.

9 April 1953

File No. SJ-1-26-135

Exhibit B-11-5

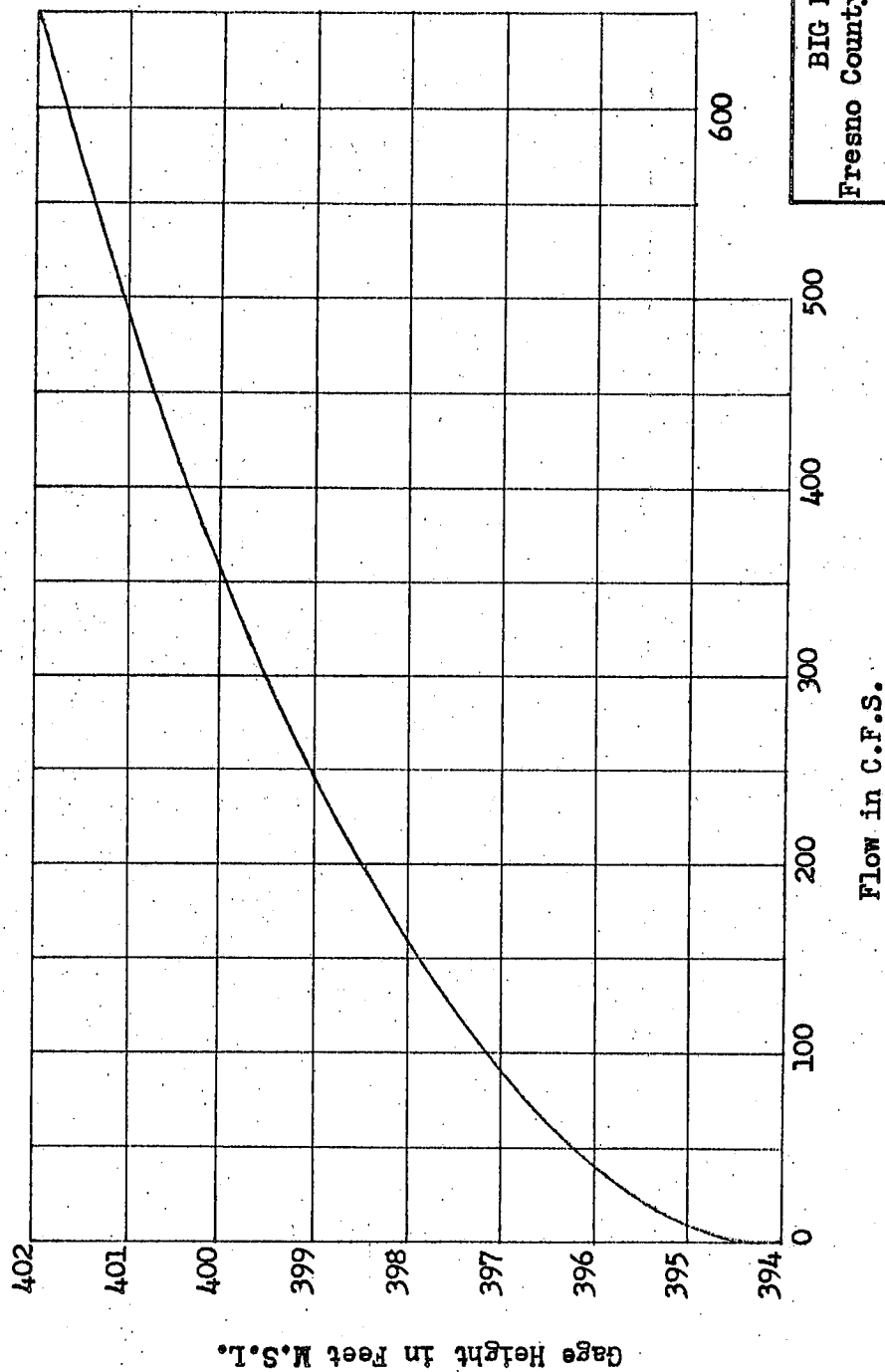


BIG DRY CREEK RESERVOIR
 Fresno County Stream Group, California
 STAGE-DISCHARGE CURVE
 WASTEWAY THROUGH DIKE
 ALONG LITTLE DRY CREEK OUTLET CHANNEL
 (Staff Gage XIII)

Revised 1 July 1954
 File No. SJ-1-26-141

Corps of Engineers Sacramento, Calif.
 Prepared by A.G.C. 20 May 1953

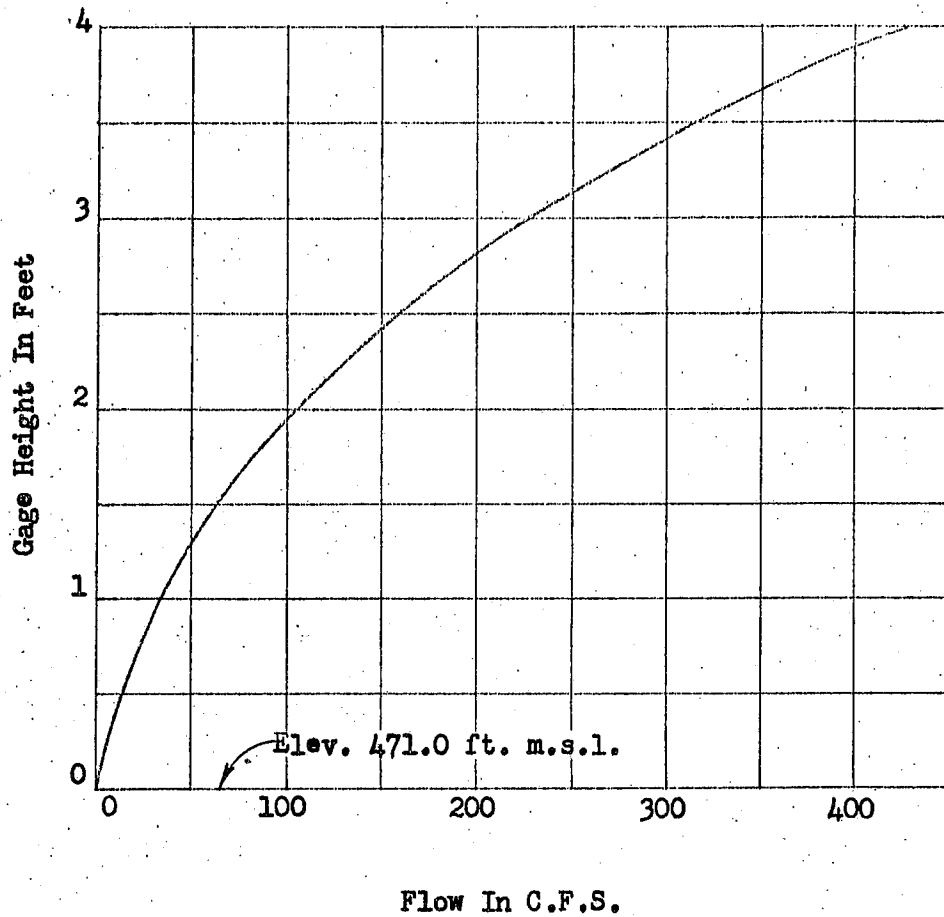
Exhibit B-11-6



BIG DRY CREEK RESERVOIR
 Fresno County Stream Group, California
 STAGE-DISCHARGE CURVE
 BIG DRY CREEK OUTLET CHANNEL

Corps of Engineers Sacramento, Calif.
 Prepared by A.G.C. 8 April 1953

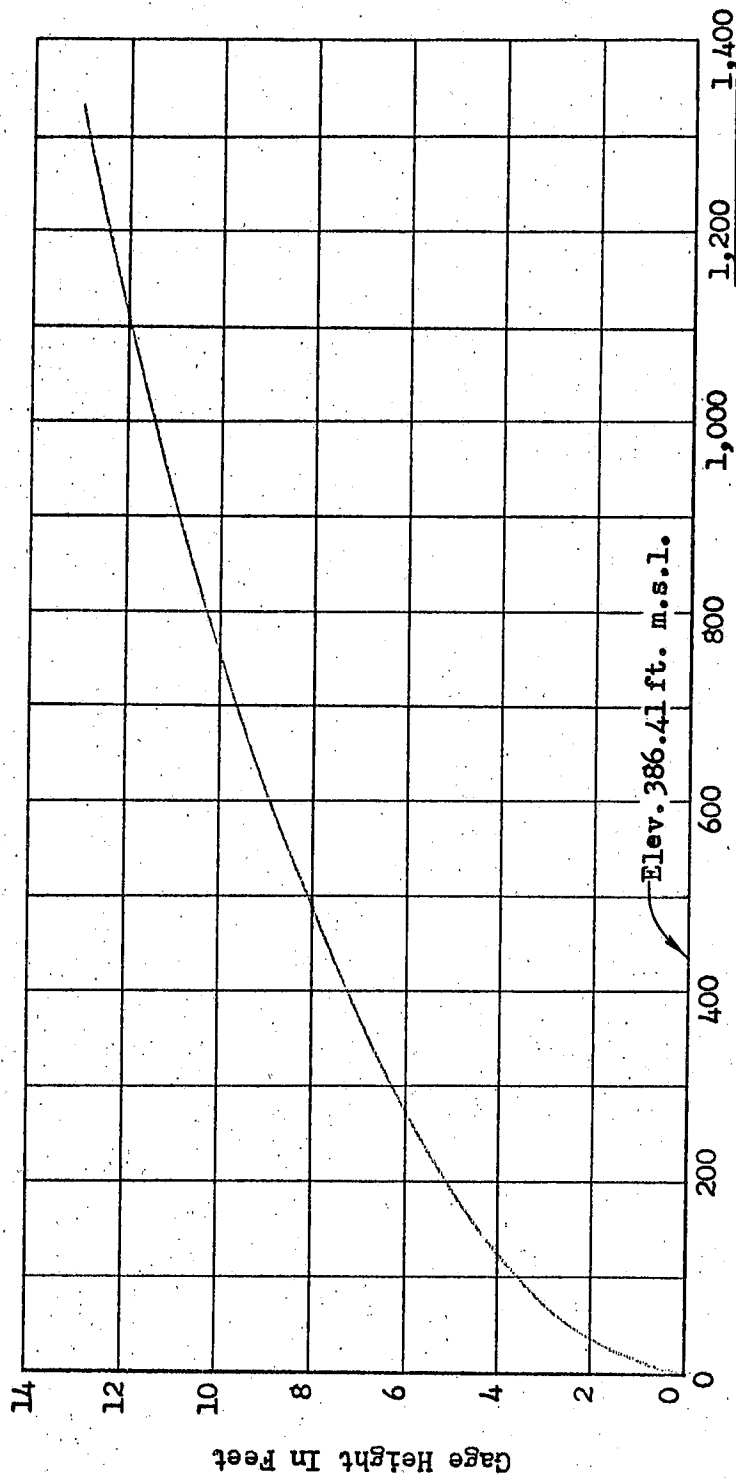
File No. SJ-1-26-133



BIG DRY CREEK RESERVOIR	
Fresno County Stream Group, California	
STAGE-DISCHARGE CURVE	
DOG CREEK BELOW	
DOG CREEK OUTLET STRUCTURE	
Corps of Engineers	Sacramento, Calif.
Prepared by AGC	8 April 1953

File No. SJ-1-26-139

Exhibit B-11-8



Flow in C.F.S.

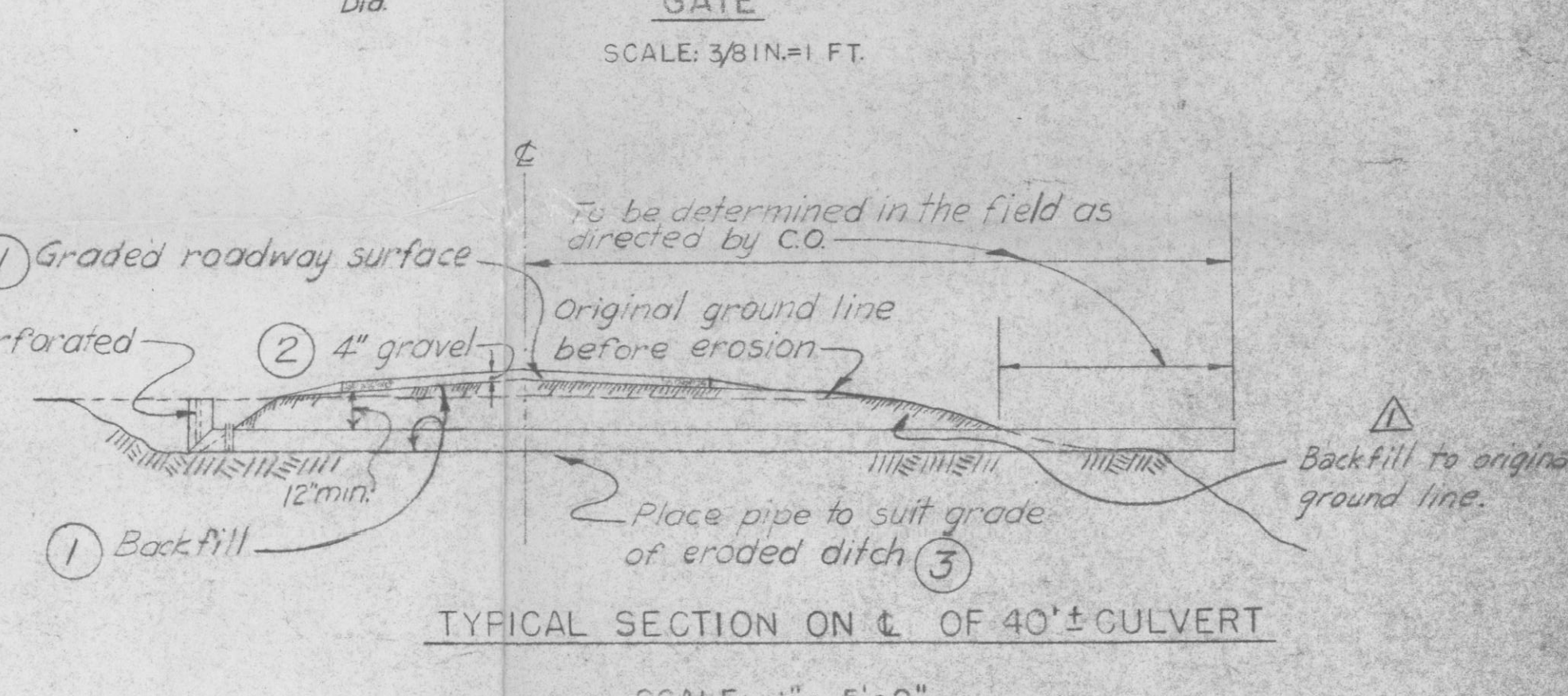
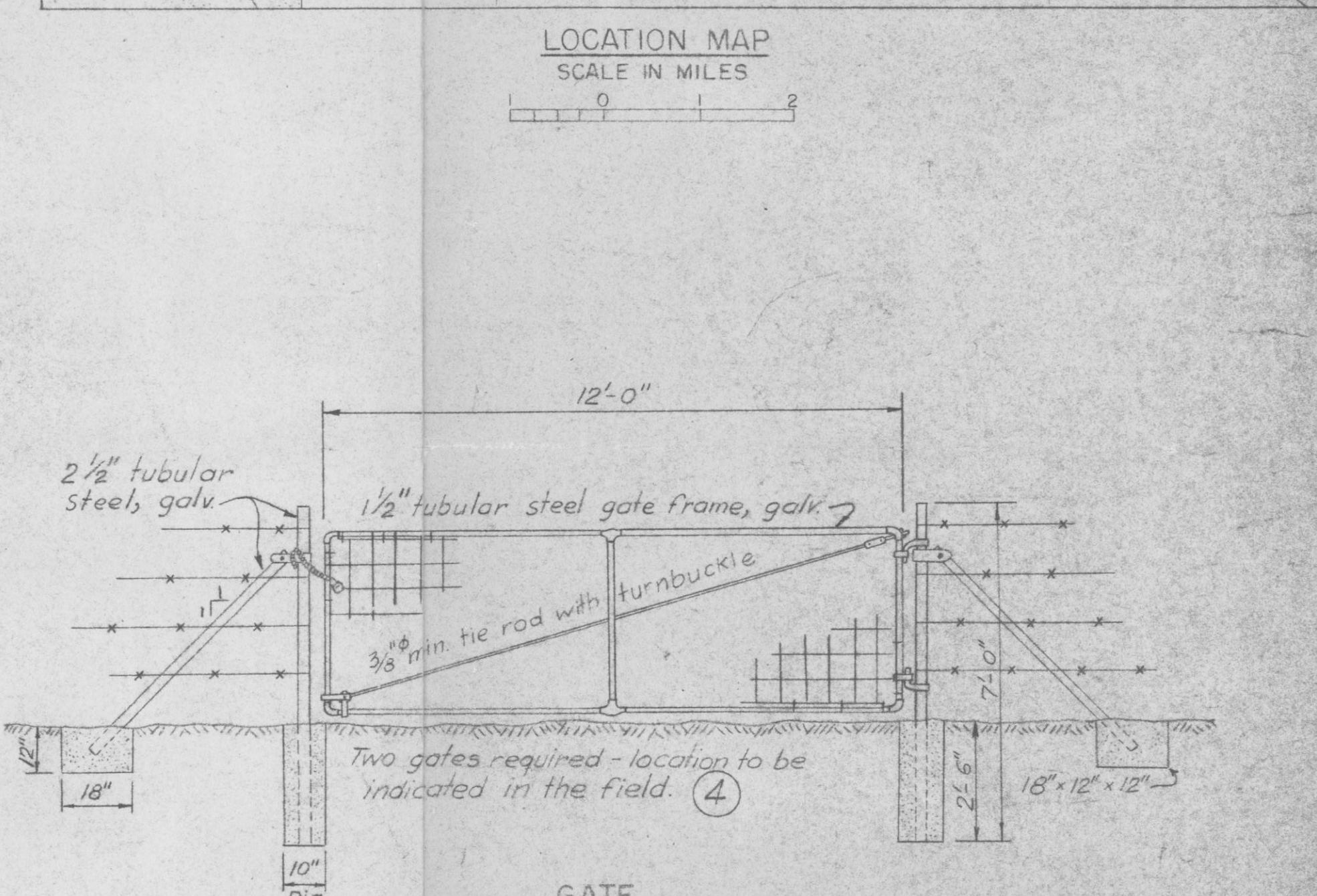
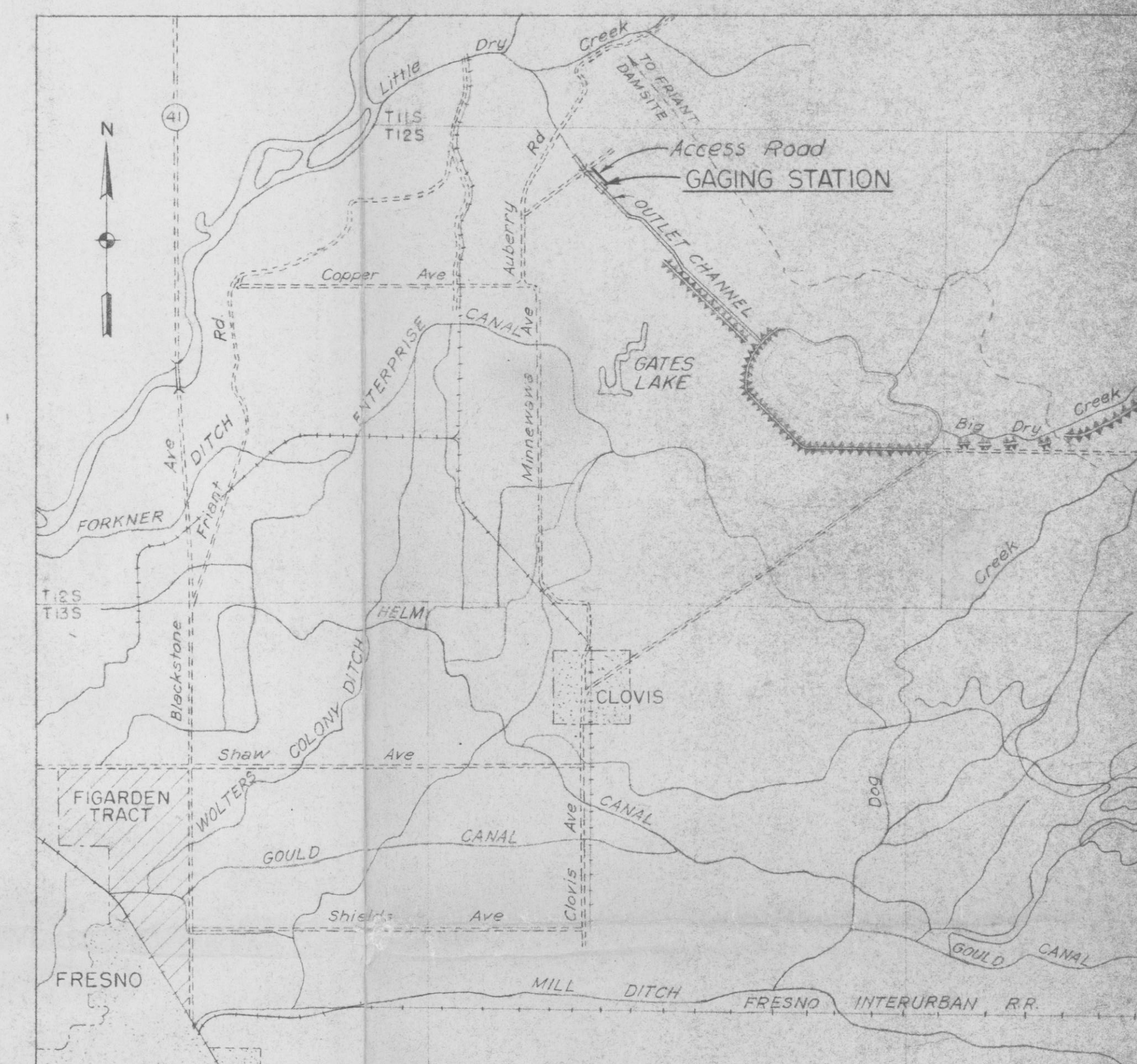
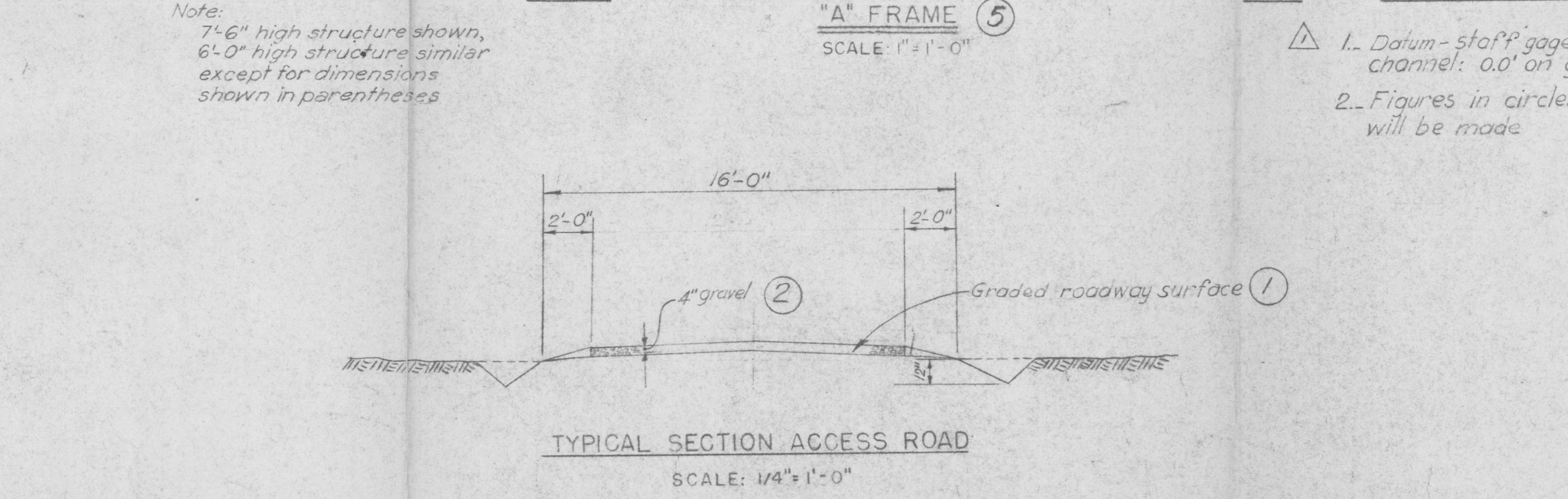
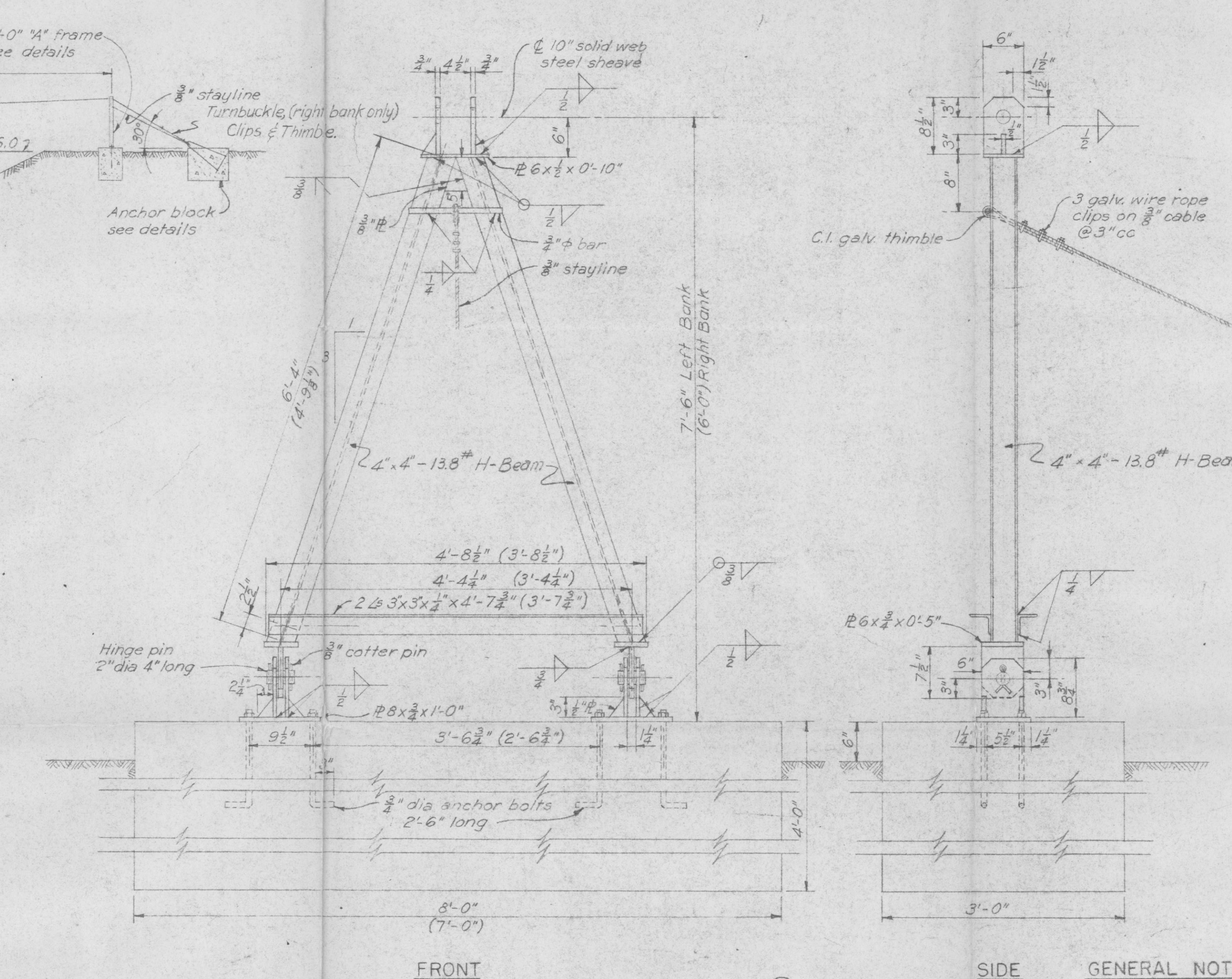
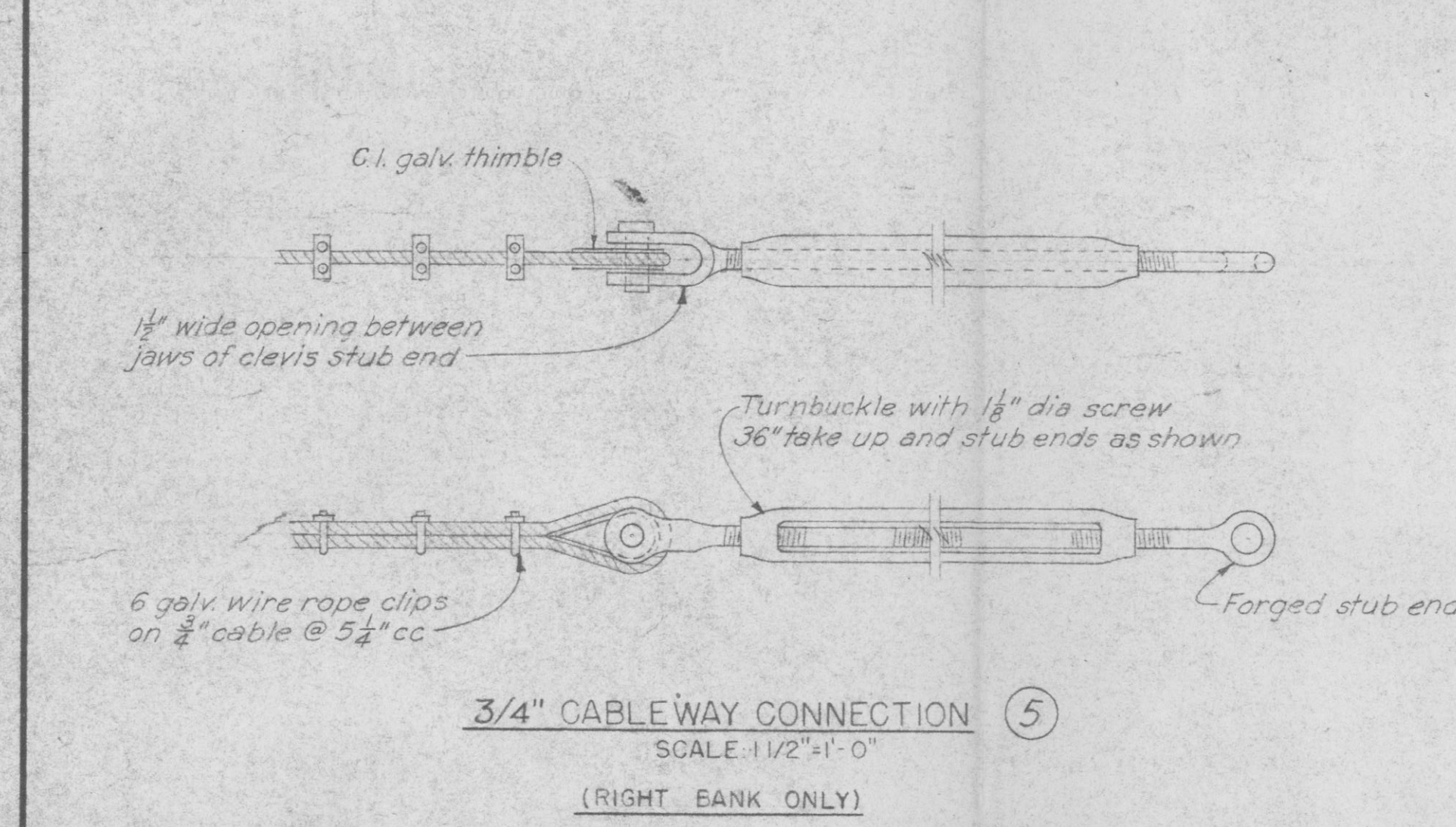
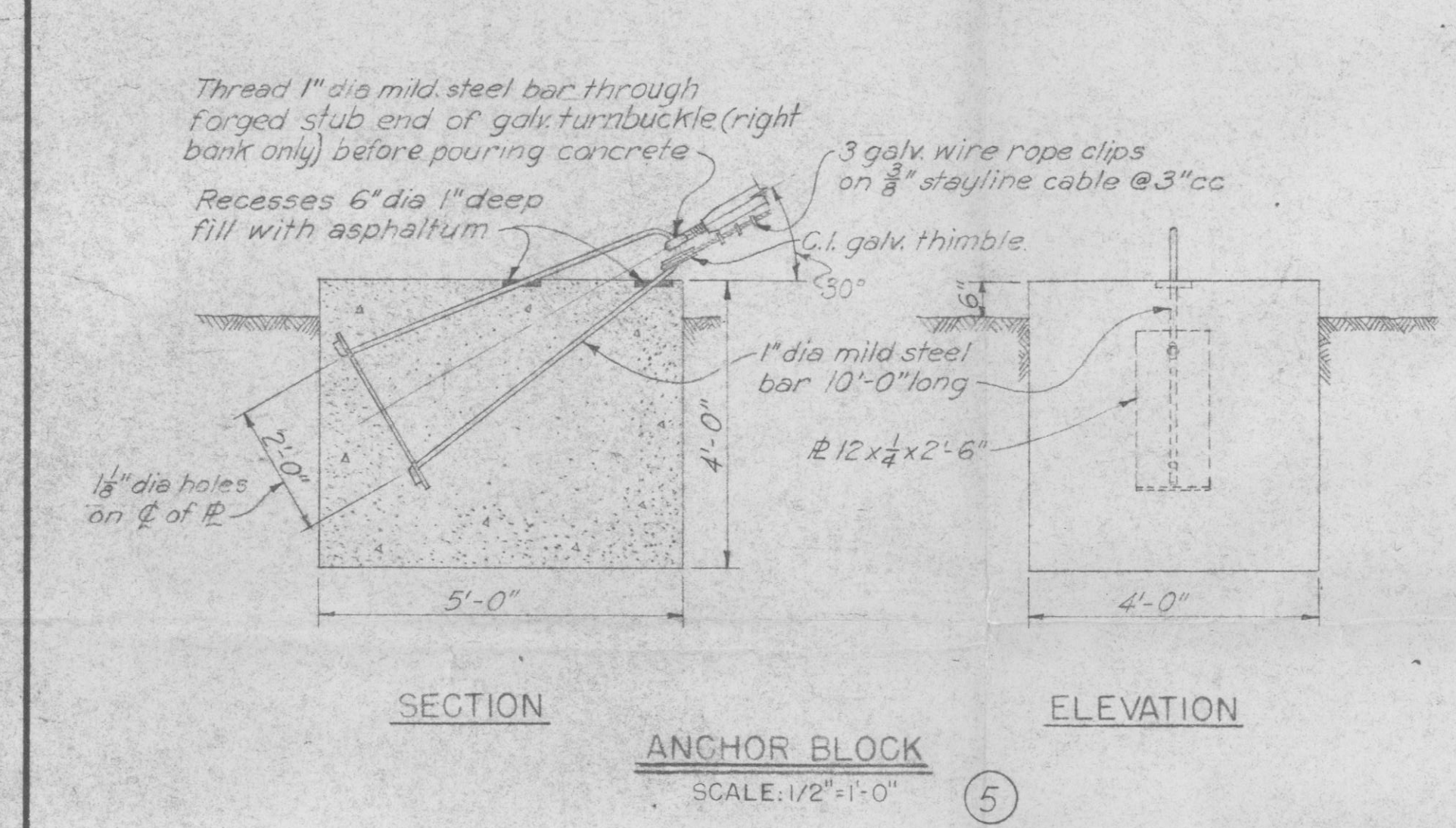
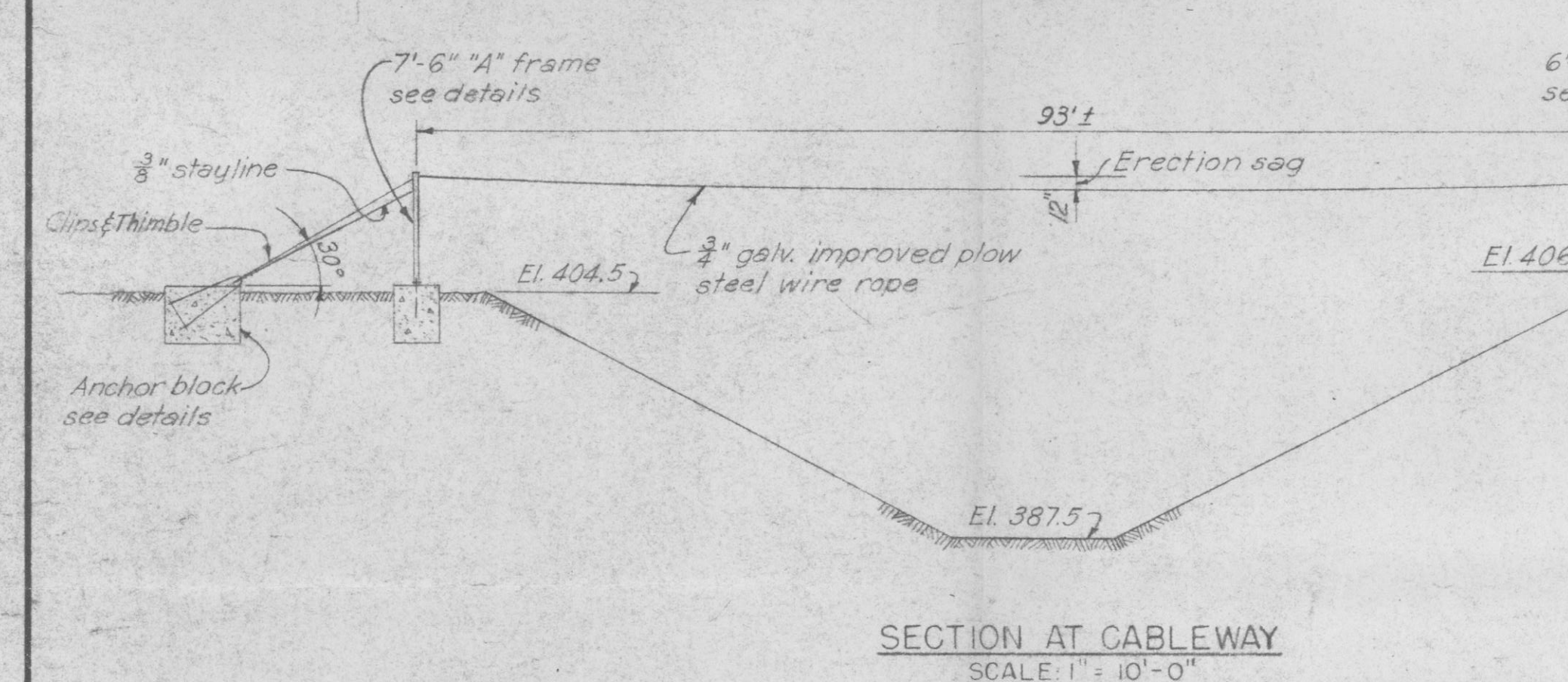
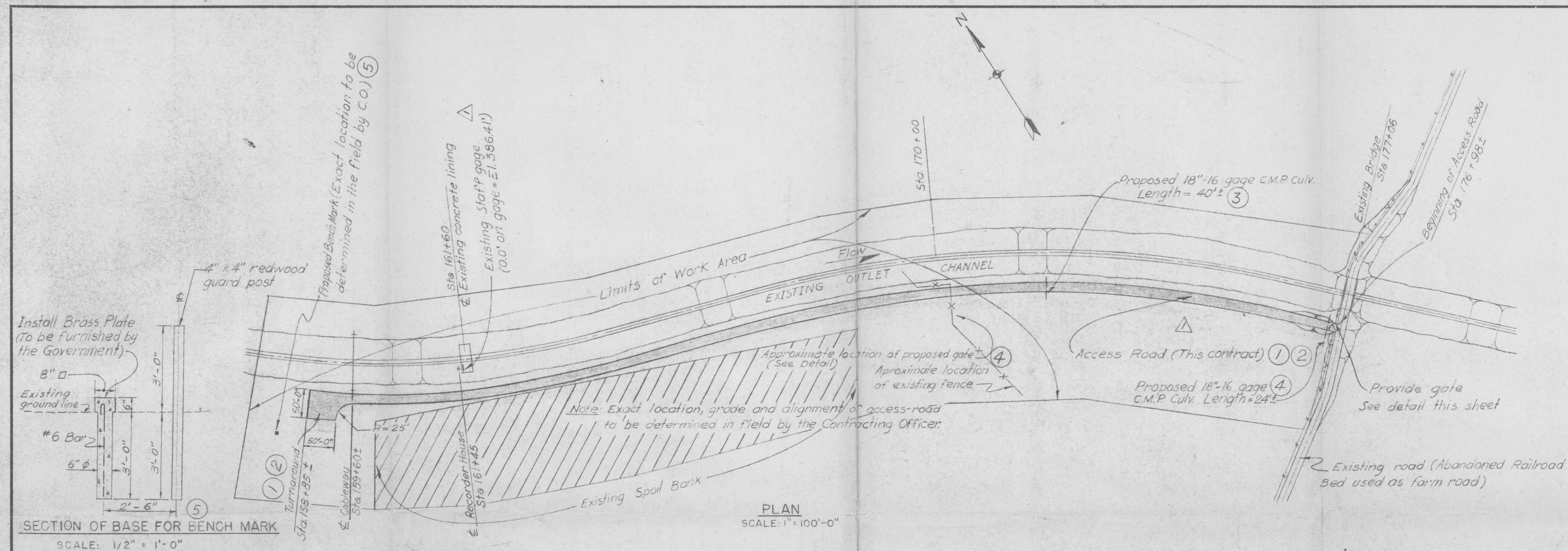
BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California
STAGE-DISCHARGE CURVE
LITTLE DRY CREEK OUTLET CHANNEL
AT CONCRETE CONTROL SECTION
(Staff Gage XII)

Revised 1 July 1954

File No. SJ-1-26-142


Corps of Engineers Sacramento, Calif.

Prepared by A.G.C. 8 April 1953



ined section of outlet
5.41'
ns under which payment

SCALE: 1" = 5'-0"

	1 NOV 54	Revised Access Road location and General Note	H. J.
REVISION	DATE	DESCRIPTION	

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

DRAWN BY:

R K J & H J

FRESNO COUNTY STREAM GROUP, CALIFORNIA

CHECKED BY

W. R. M.

BIG DRY CREEK RESERVOIR

DESIGNED BY

CHIEF DESIGN UNIT No. 2


OUTLET CHANNEL TO LITTLE DRY CR


SUBMITTED BY

CHIEF S. C. U. C. 1 SECTION

CABLEWAY & ACCESS ROAD

APPROVED:

APPROVED:  DISTRICT ENGINEER

 CHIEF ENGINEERING DIVISION

SCALE: AS SHOWN

SPEC. NO. 1837

FILE NO. SJ-1-9-147

SHEETS

SHEET NO. 1

DATE:

CORPS OF ENGINEERS, U. S. A.
18 OCTOBER 1954

DISTRICT ENGINEER

147/1 TO 147/2

147/1

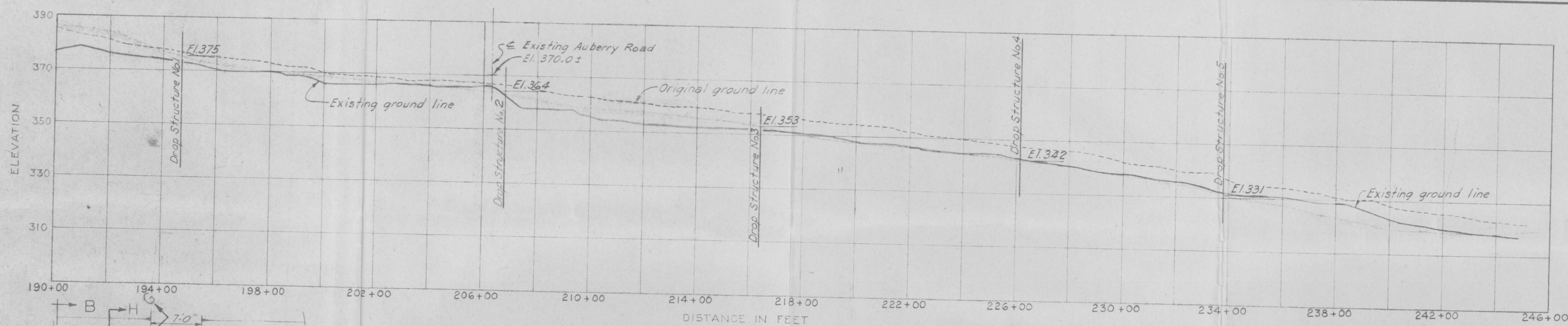
Scale Engineer



GENERAL NOTES

1. Datum is based on U.S.G.S. survey primary leveling of 1901 to 1908, subject to 1929 adjustment.
2. For Drop Structure plan, profile and sections see sheet 5J-1-9-124/2

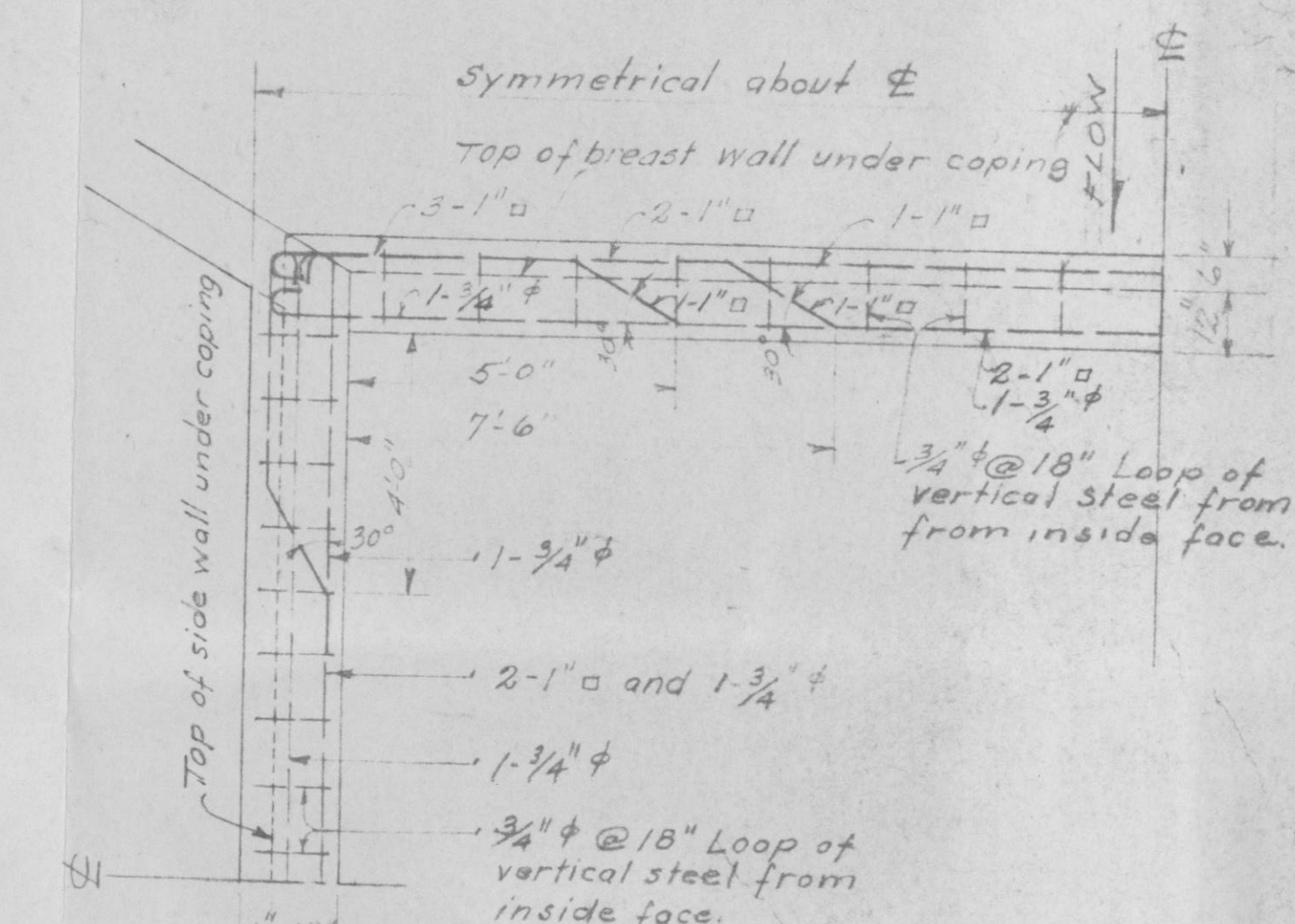
REVISION	DATE	DESCRIPTION	BY	BY
CORPS OF ENGINEERS, U. S. ARMY OFFICE OF THE DISTRICT ENGINEER SACRAMENTO DISTRICT SACRAMENTO, CALIFORNIA				
DRAWN BY: AH CHECKED BY: G. J. S. PREPARED BY: J. H. Brooks SUBMITTED: J. H. Brooks APPROVED: J. H. Brooks CHIEF DESIGN BRANCH		FRESNO COUNTY STREAM GROUP, CALIFORNIA BIG DRY CREEK RESERVOIR OUTLET CHANNEL TO LITTLE DRY CREEK DROP STRUCTURES GENERAL PLAN AND LOCALITY MAP		
APPROVED: J. H. Brooks DISTRICT ENGINEER		SCALE: AS SHOWN SPEC. NO. 1710 FILE NO. SJ-1-9-124 SHEETS 124/1 TO 124/2 SHEET NO. 124/1		
DATE: 4 September 1952				



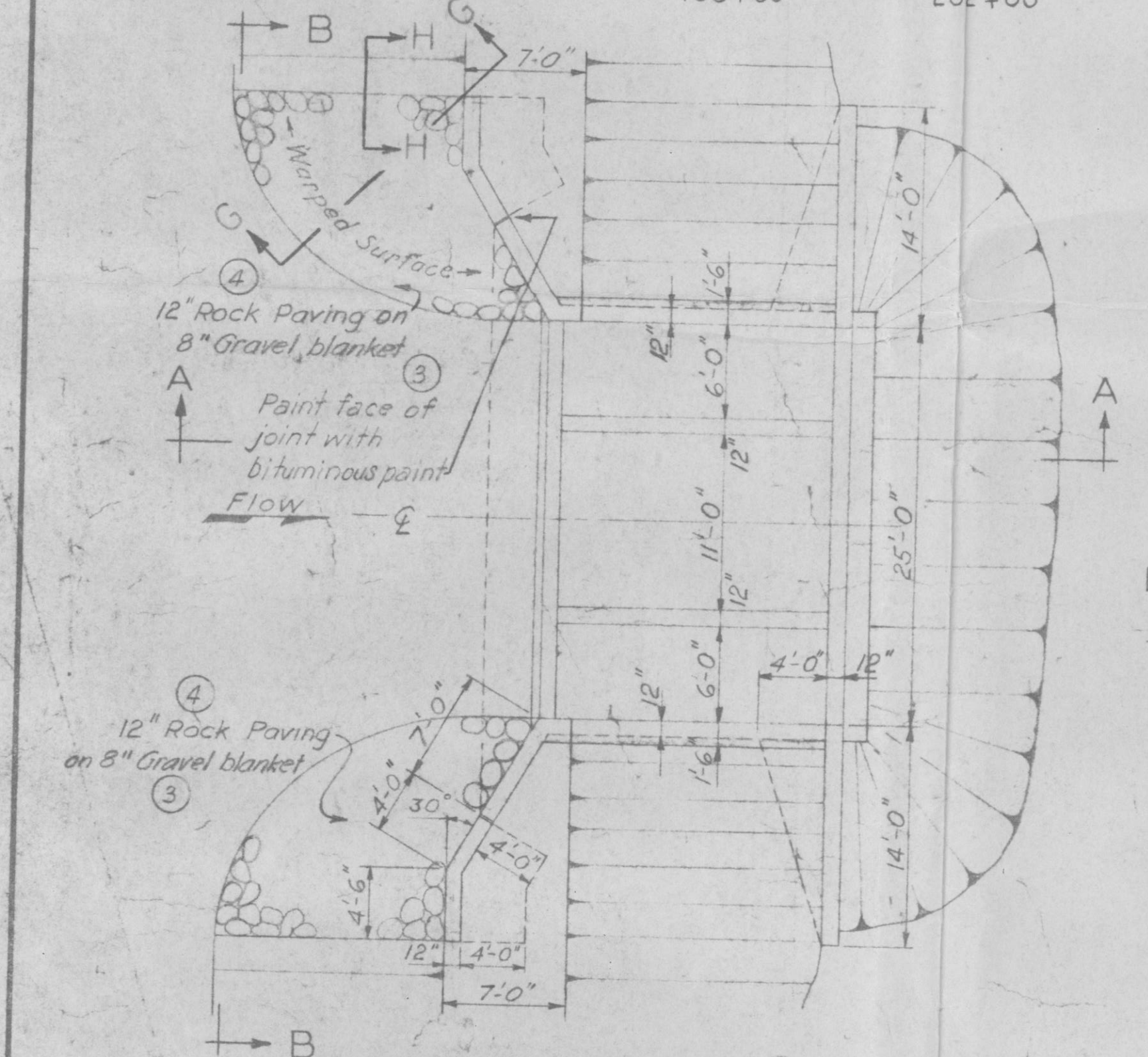
PROFILE ON NATURAL CHANNEL

SCALE: 1"=20'-0" VERT.
1"=200'-0" HORIZ.

Note: Exact location of structures to be determined in the field by the Contracting Officer

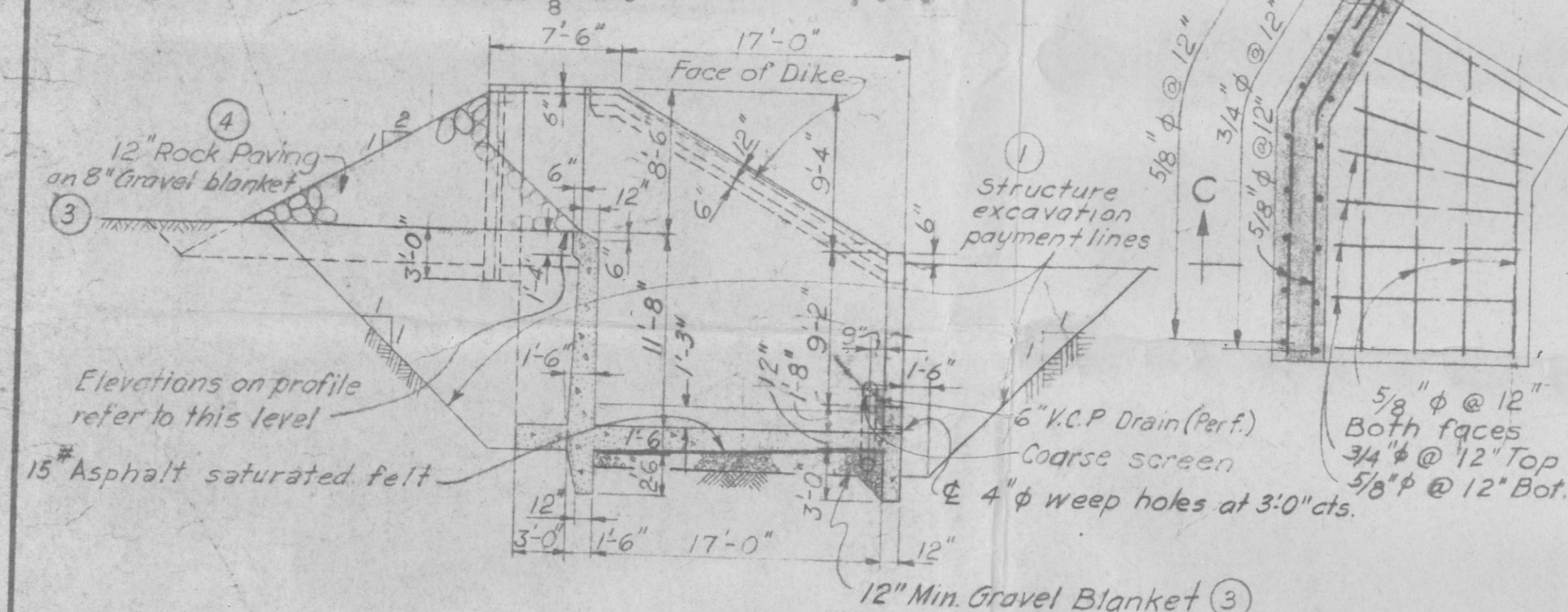
PLAN OF COPING
BREAST WALL & SIDE WALL

SCALE: 3/8"=1'-0"



PLAN

SCALE: 1/8"=1'-0"

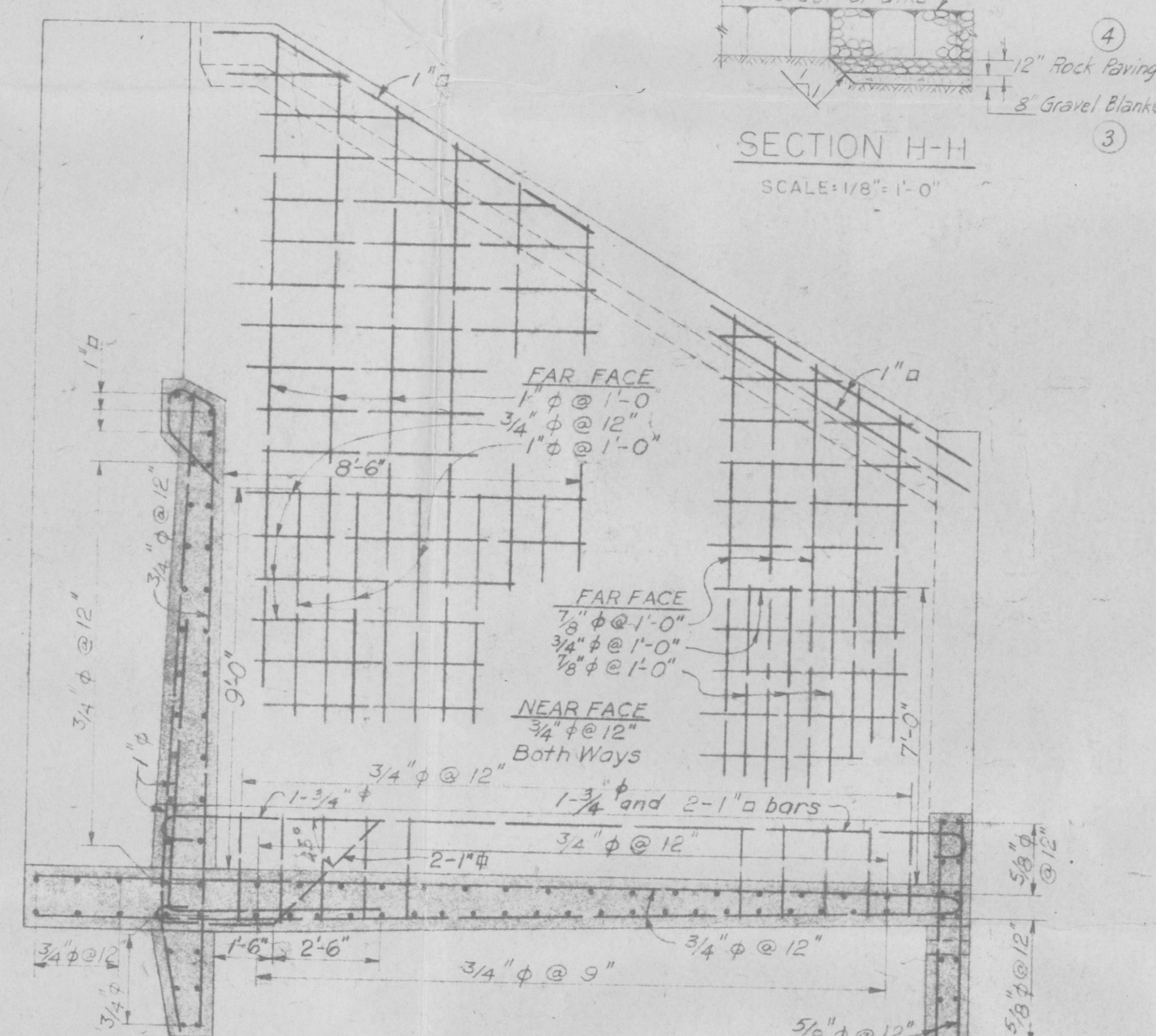


SECTION A-A

SCALE: 1/8"=1'-0"

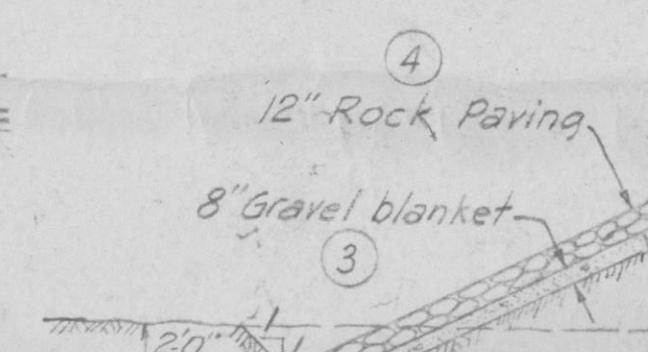
HALF PLAN

SCALE: 3/8"=1'-0"



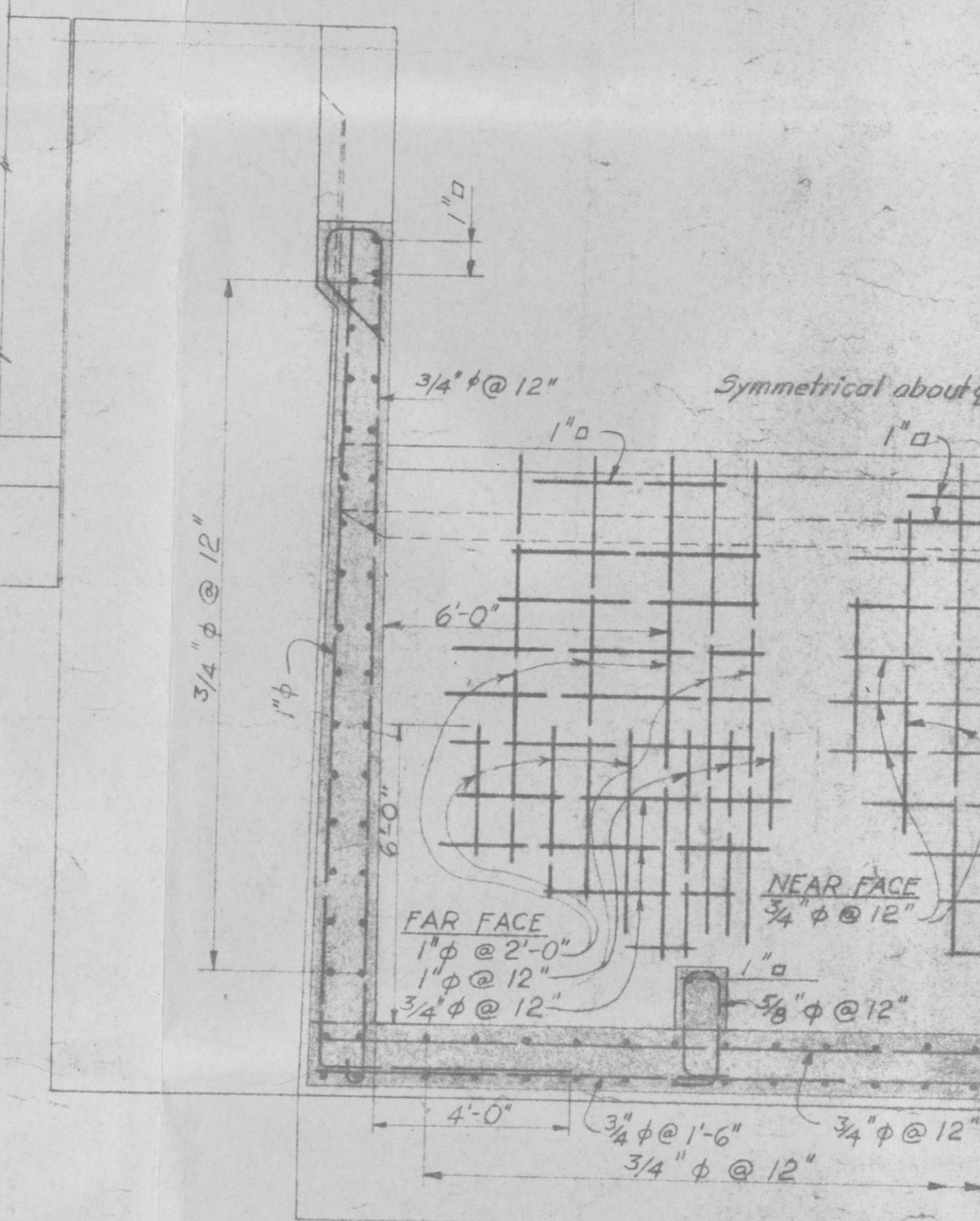
SECTION E-E

SCALE: 3/8"=1'-0"



SECTION G-G

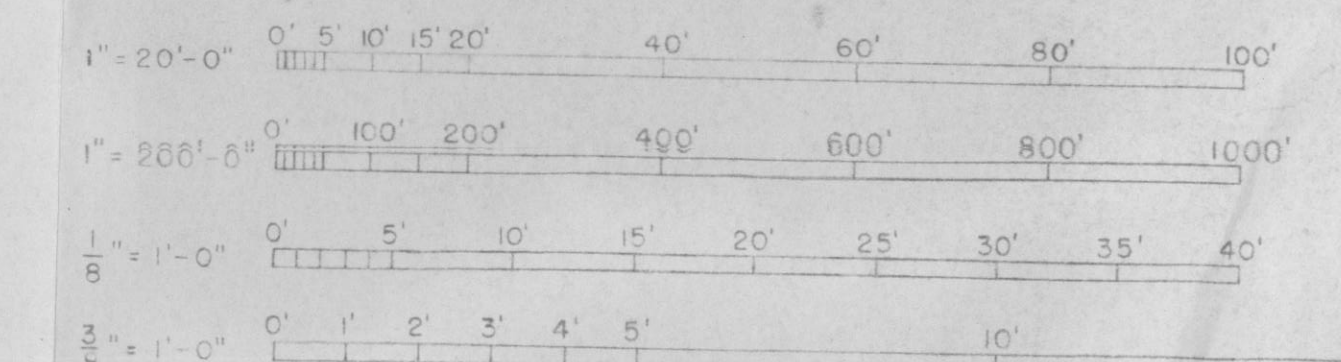
SCALE: 1/8"=1'-0"



SECTION F-F

SCALE: 3/8"=1'-0"

GRAPHIC SCALES



GENERAL NOTES

- Figures in circles indicate item number under which payment will be made.
- Payment for all concrete shown on this sheet will be made at contract price item (5).
- Payment for all steel reinforcement shown on this sheet will be made at contract price item (7).
- Structure excavation payment lines to be 1'-6" outside base of structure and sloped up 1 on 1 unless otherwise noted.
- All exposed edges of concrete to be chamfered 3/4" unless otherwise noted.
- All steel reinforcement to be placed 3" clear from face of concrete unless otherwise noted.
- Steel reinforcement splices will be staggered as directed by the Contracting Officer.
- All stationing is determined from paper location and is subject to revision in the field.
- Payment for cement will be made at contract unit price item (6).

REVISION	DATE	DESCRIPTION	BY
CORPS OF ENGINEERS, U. S. ARMY OFFICE OF THE DISTRICT ENGINEER SACRAMENTO DISTRICT SACRAMENTO, CALIFORNIA			
DRAWN BY:	W.K.S. & K.E.M.	FRESNO COUNTY STREAM GROUP, CALIFORNIA	
CHECKED BY:	S. J. S.	BIG DRY CREEK RESERVOIR	
PREPARED BY:	W. J. Brooks	OUTLET CHANNEL TO LITTLE DRY CREEK	
DESIGNED BY:	W. J. Brooks	DROP STRUCTURES	
APPROVED:	W. J. Brooks	PLAN, PROFILE AND SECTIONS	
DESIGN	BRANCH	CHIEF ENGINEERING DIVISION	
APPROVED:	W. J. Brooks	SCALE: AS SHOWN SPEC. NO. 1710	
CORPS OF ENGINEERS, U. S. ARMY	DISTRICT ENGINEER	FILE NO. SJ-1-9-124	
DATE: 4 September 1952		SHEETS 124/1 TO 124/2	124/2

LBB/sdt

501

SUBJECT: Submission of Reservoir Regulation Manual for Big Dry Cr Res
Bridg 800.21(Big Dry Cr)(4Sept53) 4th Ind

Sac Dist, Corps of Engrs, US Army, Sacramento, Calif 15 JUL 1954

TO: Div Engr, So Pac Div, Corps of Engrs, US Army, San Francisco, Calif

1. Subject manual has been revised to conform with comments in the preceding 1st and 2d indorsements and has been brought up-to-date. Also, part A has been reorganized to agree with suggestions of the Division Engineer in 1st indorsement dated 2 February 1954 on letter of this office dated 12 November 1953, subject, "Submission of Reservoir Regulation Manual for Pine Flat Project, Kings River, California." Paragraph a of the regulations (part C) has been reworded as recommended in 2d indorsement from this office dated 11 May 1954 on OSG letter of 14 January 1954, subject, "Regulations for Big Dry Creek Reservoir and Diversion, California."

2. Revision sheets are inclosed for approval and for insertion in copies of the manual retained in OGE and BFD.

1 Incl ^{FOR THE} DISTRICT ENGINEER:
(quint)

1 Added (1 incl)

2. Rev shts dtd 1 July

1. 1954, cy nos. 1-5

cc: Constn-Opn Div w/cy #12
Design Br w/cy #11
Engr Div Serv Sec w/cy #9
Planning Br w/cy #8
Res Reg Sec

H. A. NELSON
Executive Assistant

OPERATIONS DIVISION

SPKGD 800.2 (Big Dry Cr.)

4 SEP 1953

SUBJECT: Submission of Reservoir Regulation Manual for Big Dry
Creek Reservoir and Diversion, California

TO: Division Engineer
South Pacific Division
Corps of Engineers, US Army
San Francisco 19, California

1. By letter dated 15 September 1950, subject "Operation and Maintenance Manual, Big Dry Creek Reservoir and Diversion Project," the Operation and Maintenance Manual for Big Dry Creek Reservoir and Diversion Project, Fresno County Stream Group, California, dated 15 September 1950 was submitted for approval. By 2d indorsement thereon, dated 24 September 1951, the Chief of Engineers requested that a separate reservoir regulation manual be prepared in accordance with paragraph 4220.01, Orders and Regulations and that rules and regulations be prepared for publication in the Federal Register.

2. There is submitted herewith for approval the Reservoir Regulation Manual for Big Dry Creek Reservoir and Diversion dated 4 August 1953, including a draft of the rules and regulations for operation of the project by the State of California or its designated agent in a form suitable for publication in the Federal Register. This draft of the regulations has been reviewed by the State of California. By letter dated 22 July 1953, the Reclamation Board, State of California, stated that the regulations are satisfactory.

SPRUE 800.2 (Big Dry Cr.)

SUBJECT: Submission of Reservoir Regulation Manual for Big Dry
Creek Reservoir and Diversion, California

By letter dated 31 August 1953, the Reclamation Board has been requested to operate the project in accordance with these regulations pending their publication in the Federal Register.

3. It is requested that the inclosed reservoir regulation manual be approved at an early date and that the rules and regulations be published in the Federal Register.

FOR THE DISTRICT ENGINEER:

1 Incl (in quint)

1. Res. Reg. Man.
dtd 24 Aug 53

E. A. BRULE
Executive Assistant

cc: Operation Div.
Design Br.
Planning Br.
Res. Reg. Sec.

APPENDIX II

RESERVOIR REGULATION MANUAL FOR BIG DRY CREEK RESERVOIR AND DIVERSION FRESNO COUNTY STREAM GROUP, CALIFORNIA

Prepared in the Sacramento District
Corps of Engineers, U. S. Army
Sacramento, California, dated 24 August 1953

Approved by the Chief of Engineers 6 January 1954

E. D. File _____

REVISIONS

Date	New pages or charts	Date approved by O.C.E.
1 July 1954	Part A: Text extensively revised; Charts A-7, A-13, A-16, and A-17 revised; Paragraphs 12.1 and 12.2; and Charts A-4.1 to 4.4 added. Part B: Paragraphs 7, 13, 14, and 16 revised; Charts B-1.1 and Chart B-3, sheet 3 added. Part C: Paragraph (a) revised.	

PART A - General Information

PART B - Operation

PART C - Regulations

PART A

GENERAL INFORMATION

BIG DRY CREEK RESERVOIR AND DIVERSION
FRESNO COUNTY STREAM GROUP, CALIFORNIA

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1	Description of the project area	2
2	Project characteristics	3
2	System regulation	3
2	Floods and flood damage	4
2	Description of the project	10
2	Changes to the authorized plan	11
2	Construction history	12
4	Hydraulic basis of the project	12
4	Regulation for operation	15
6	Hydraulic facilities	17
6	Water rights	18
6	Ownership	18
6	Operation	19
6	Costs	20
6	Benefits	21

PART A

GENERAL INFORMATION

BIG DRY CREEK RESERVOIR AND DIVERSION
FRESNO COUNTY STREAM GROUP, CALIFORNIA

24 August 1953

(Revised 1 July 1954)

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A-2	Plan of Big Dry Creek Reservoir and Diversion	A-2
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A-4.1	Big Dry Creek Outlet Structure	A-4.1
A-4.2	Top Creek Outlet Structure	A-4.2
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A-5	Area and Capacity Curves, Big Dry Creek Reservoir	A-5
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A-10	Partial Gate Opening Curves, Little Dry Creek Outlet	A-10
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PART A

GENERAL INFORMATION

BIG DRY CREEK RESERVOIR AND DIVERSION
FRESNO COUNTY STREAM GROUP, CALIFORNIA

TABLE OF CONTENTS

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3	Description of the project area	1
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10	Description of the project	2.2
11	Changes to the authorized plan	3
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A-2	Plan of Big Dry Creek Reservoir and Diversion
A-3	Big Dry Creek Reservoir, Profiles and Sections
A-4	Big Dry Creek Reservoir, Spillway Plan and Sections
A-4.1	Big Dry Creek Outlet Structure
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A-5	Area and Capacity Curves, Big Dry Creek Reservoir
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A-7	Partial Gate Opening Curves, Big Dry Creek Outlet
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A-13	Partial Gate Opening Curves, Dog Creek Outlet
A-14	Stage-Discharge Curve, Dog Creek below Outlet
A-15	Stage-Discharge Curve, Dog Creek Diversion Channel
A-16	Stage-Discharge Curve, Wasteway
A-17	Stage-Discharge Curve - Little Dry Creek Outlet Channel at Concrete Control Section
A-18	Hydrographs of Recorded Flow - Dog Creek near Academy
A-19	Hydrographs of Recorded Flow - Big Dry Creek near Academy

PART A
GENERAL INFORMATION

BIG DRY CREEK RESERVOIR AND DIVERSION
FRESNO COUNTY STREAM GROUP, CALIFORNIA

1. Authority and scope. - This appendix to the Master Manual of Reservoir Regulation, San Joaquin Basin, California, is prepared in accordance with instructions contained in paragraph 4220.01, Orders and Regulations, and in the Engineering Manual, Civil Works Construction, Part CXXXVI, Chapter 6 and 7. It comprises descriptive information and operation regulations for Big Dry Creek Reservoir and Diversion. A description of the general plan of reservoir regulation for the San Joaquin River Basin, of which this is a unit, is given in the Master Manual.

2. Project authorization. - Periodic and serious flooding of the city of Fresno and the community of Clovis, as well as of intensively cultivated agricultural land and highly developed suburban communities, led to the authorization of the Big Dry Creek Reservoir and Diversion project. The project was authorized by Section 3 of Public Law No. 228, Chapter 377, 77th Congress, first session, H. R. 4911, approved 18 August 1941, which reads in part as follows:

"The project for the Fresno County Stream Group for flood control is hereby authorized to be constructed substantially in accordance with the recommendations of the Chief of Engineers, in House Document Numbered 845, Seventy-sixth Congress, third session....."

3. Description of the project area. - Big Dry Creek and Dog Creek, the two most important streams of the Fresno County Stream Group, have a combined drainage area above Big Dry Creek Dam of 86 square miles of Sierra Nevada foothill area in Fresno County, California, lying between upper San Joaquin River and Kings River (see chart A-1). Big Dry Creek and Dog Creek rise at elevations of 4,500 and 2,500 feet respectively, on ridges near the foot of the western slope of the Sierra Nevada and flow generally southwest through rolling hills to the head of a long narrow alluvial course down which they flow in parallel courses to the San Joaquin Valley floor at an elevation of about 300 feet. Flow in the upper channels is usually continuous throughout the year, but because of heavy percolation losses in the alluvial cone reach, little or no surface flow reaches the valley floor during the summer months. The upper portion of the watershed has a light forest cover interposed with a moderate cover

of brush, while the lower portion has a light brush cover interposed with extensive grass areas. Soil depths vary from shallow to moderate. About 88 percent of the precipitation occurs during the period of November through April, and only scattered showers occur during the other months. Precipitation occurs as rain over most of the watershed, but the extreme upper portion may receive both rain and snow. The normal seasonal precipitation over the watershed varies from about 13 inches at the dam to about 33 inches in the upper portion of the basin and averages about 19 inches. The watershed is sparsely populated.

4. Downstream from Big Dry Creek Dam, the two creeks diverge and flow across a gently sloping flood plain with an area of about 400 square miles to Murphy Slough, a distributary of Kings River. As a result of heavy percolation losses and irrigation diversion, the channels across the valley floor have progressively diminishing capacities and practically disappear before reaching Murphy Slough. These channels, together with the channels of the other creeks of the group, are crossed by several main irrigation canals which distribute Kings River water and which often intercept the entire flow of the creeks for irrigation use. Some sections of the creek channels are used to transfer irrigation water from one main canal to another. Flow in the valley floor creek channels (other than irrigation water) is usually small and intermittent and only during extremely large floods does water reach Murphy Slough. The soil of the area is deep and relatively rich. Almost all of the flood plain is either highly cultivated crop land or is settled in city and suburban communities. Fresno is the major city in the area and had a 1950 population of 90,000. The total population in the flood plain is about 140,000. Two trans-continental railroads, one United States Highway, and numerous county and state roads serve this area.

5. Runoff characteristics. - Flows of Big Dry and Dog Creeks are intermittent, occurring during and after rainfall, and a large proportion of the runoff is dissipated by percolation before it reaches the project. Snow rarely falls in the area, and consequently, snowmelt is not an important factor in producing runoff. The regimen of runoff is best illustrated by hydrographs of recorded flows on charts A-18, A-19, and B-3.

6. Upstream regulation. - Except for minor irrigation diversions, which have no appreciable effect on flood flows, there is no regulation of stream flow above Big Dry Creek Reservoir.

7. Floods and flood damages. - Floods in the project area are caused by intense rainfall on the foothill area above the dam site occurring at a time when the watershed is wet from prolonged previous rains, a condition which sometimes occurs during general winter or spring storms. The resultant runoff at the foothill line is characterized by short high peaks, but, before construction of the project, these peaks were rapidly flattened by channel and overbank storage on the alluvial cone and valley floor. Flood volumes were larger than could be carried out of the area by the small channels and irrigation canals, with

resultant widespread shallow flooding at scattered points on the valley floor. Flooding began near the foothill line behind the first road embankment or canal bank. Subsequent failure of these obstacles released the impounded water into lower cells, which failed in turn with progressive erratic extension of the flooded areas. Cross canals sometimes carried flood water considerable distances away from the flooded area and then released it into remote detached cells when the canal banks failed.

8. Very little information of a quantitative nature is available with respect to floods prior to 1937. Stream flow records on Dog and Big Dry Creeks began in 1940. Daily hydrographs of record up to the time of construction are shown on charts A-18 and A-19. General flooding in the vicinity occurred in 1852 and 1862 and again in 1867. In 1884 Fresno was severely flooded, and the business district had to be traversed in boats. Moderate floods occurred in 1890, 1906, and 1916. Big Dry Creek is known to have overflowed its banks one to four times per year in 18 of the 58 years preceding the completion of the project in 1948. Minor floods occurred in 1935, 1936, and 1937. The flood of February and March 1938, with an estimated peak flow of 2650 cubic feet per second and a volume of 14,400 acre-feet for the combined flow of Big Dry and Dog Creeks at the project site, was the most disastrous in recent years. This flood resulted from a 4-day storm precipitation varying from about $4\frac{1}{2}$ inches at the project to about 10 inches in the headwaters and averaging about 6 inches over the basin. On the evening of 28 February, more than 1 inch of rain fell on the basin, which had been saturated by rains in the preceding 3 months. This was followed by an intense storm of more than 2 inches in 12 hours on the morning of 2 March and storms of lesser intensity on 3 and 4 March. Partial discharge measurements and observations made by private interests were amplified by slope and cross-section measurements and rainfall-runoff studies to produce the estimated inflow hydrograph shown on chart B-1.1 and to establish the following peak and volume estimates:

<u>Stream and Location</u>	<u>Peak (cfs)</u>	<u>Volume (ac-ft)</u>
Big Dry Cr. at Morgan Hill Bridge	2,600	—
Big Dry Cr. at Reservoir site	2,000	—
Big Dry Cr. at Fowler Ave.	1,550	11,000
Dog Cr. at foothill line	1,100	—
Dog Cr. at junction with Mill Ditch	750	3,500

Damage from this flood has been estimated as follows:

<u>Type of damage</u>	<u>Amount</u>
Agriculture	\$ 41,000
Erosion of land	8,000
Property, public and private	373,000
Highways, roads and bridges	16,000
Cost of fighting floods	22,000
Personal and business losses during flood and cost of rehabilitation	55,000
Total	\$515,000

Damage to homes and to private and commercial property was over two-thirds of the total damage resulting from the 1938 flood. This damage occurred principally in the city of Fresno and its suburban communities. The highly developed Figarden residential tract was flooded to depths of 1 to 4 feet. Second in importance were the losses in the rural areas where valuable crops were inundated and soils were eroded. Inundation of the downtown section of Fresno was prevented by cutting certain canal banks and flooding nearby valuable suburban and agricultural lands.

9. The project provides flood protection to about 47,000 acres of cultivated crop land and 3,100 acres of urban area. Because the pre-project flooding was shallow in nature it did not constitute a serious threat to life. The average annual flood benefits from the project on the basis of 1953 prices are estimated at \$450,000. Should the project design flood occur, flood damages of about \$6,000,000 would be prevented on the basis of 1953 prices.

10. Description of the project. - Pertinent data on the Big Dry Creek Reservoir and Diversion Project are given in paragraph 16, and drawings are shown on charts A-2 through A-4. The project consists of:

a. A compacted earthfill dam across Big Dry Creek with a length of 20,000 feet, a crest elevation of 435 feet, and a maximum height of 40 feet. It is capable of impounding 16,250 acre-feet of water at spillway crest elevation 425 feet. A 4'-0" by 5'-0" gated conduit regulates outflows to Big Dry Creek, and a 6'-0" by 5'-0" conduit with two 4'-0" by 5'-0" gates regulates outflows diverted through the Little Dry Creek Outlot Channel to Little Dry Creek. Reservoir area and capacity data are given on charts A-5 and A-6, and outflow rating curves are given on charts A-7 through A-11.

b. An unlined spillway channel (with a concrete control section) through a saddle near the right end of the dam, having a capacity of 13,300 cubic feet per second with water level at 430 feet. The spillway rating curve is given on chart A-12.

c. An earth dike across Dog Creek with a length of 2,500 feet and a maximum height of 19 feet, containing twin 48" diameter gated conduits discharging into Dog Creek. Outflow rating curves are shown on charts A-13 and A-14.

d. An unlined diversion channel 2,400 feet long and about 340 feet wide extending from a point on Dog Creek immediately above the dike to a point on Big Dry Creek several miles upstream from the reservoir. The rating curve for this channel is given on chart A-15.

e. Dikes along the left bank of Big Dry Creek extending from Dog Creek Diversion to Big Dry Creek Reservoir with a combined length of 14,520 feet and a maximum height of 10 feet.

f. An outlet channel from Big Dry Creek Reservoir to Little Dry Creek consisting of approximately 17,700 feet of excavated channel, 5 drop structures, and 6,750 feet of dike with a maximum height of 13 feet through which there is a 50-foot wasteway for spilling excess flows. The channel intercepts runoff from five square miles of local area below the dam. Rating curves for the wasteway and for the channel at the control section downstream of the wasteway are given on charts A-16 and A-17.

11. Changes to the authorized plan. - Changes to the authorized plan are of minor significance and are as follows:

a. A control weir and twin gated conduit have been substituted for the automatic outlet and sluice gate proposed in the project document.

b. Trash racks on outlet structures were deleted.

c. The five drop structures on the Little Dog Creek Outlet Channel were deleted from the project construction during 1946 and 1947 but were built by the Corps in 1952-53 after the project had been turned over to local interests.

12. Construction history. - Construction of Big Dry Creek Dam and appurtenant works was initiated 15 April 1947, and completed 27 February 1948. The total costs up to that time were \$1,242,124.48. Additional funds in the amount of \$130,000 were made available for the 1952-53 fiscal year to construct erosion-control works along the Little Dry Creek Outlet Channel. Construction of five drop structures in the outlet channel was initiated in October 1952 and was completed in April 1953.

Construction of control works to prevent side erosion was initiated in May 1953 and was completed in September 1953.

13. Hydrologic bases of design. - Study of observed precipitation at Fresno and other precipitation stations in the vicinity of the project area and of the ground conditions associated with past floods indicated that the major flood of March 1938 was the result of fairly heavy precipitation occurring at a time when the project watershed was wet. This coincidence of events, although unusual, cannot be considered extremely rare. From a study of flood damage data, it was concluded that the Fresno area should be protected against a flood in Dog and Big Dry Creeks some 50 percent larger than that of March 1938. Accordingly, the reservoir design flood shown on chart B-1 was obtained by multiplying the estimated 1938 flood inflow hydrograph by 1.58, which resulted in a flood having a peak flow of 4,180 c.f.s. and a volume of 22,800 acre-feet. In routing this flood through the project, it was assumed that all of the Dog Creek flow is diverted to the reservoir and that releases to Dry Creek would not occur until a few days after rainfall ceased.

14. The spillway design flood was derived from the maximum probable storm derived by the Weather Bureau, which is 142 percent greater than the storm of March 1938 in the project area and 39 percent greater than the 1909 storm center transposed to the project area, which is the largest historical storm recorded in the region. The spillway flood was computed by the basin storage-flow method described in a memorandum entitled, "Basin Storage Method of Developing Flood Hydrographs from Precipitation Records," which was furnished to the Office, Chief of Engineers by letter dated 23 February 1944. Flow-storage curves were based on the estimated 1938 flood hydrograph, and loss rates of 0.02 inches per hour were used. The resulting flood, shown on chart B-2, was routed on the assumption that the reservoir is empty at the beginning of the flood, but that all outlets are closed and inoperative.

15. Responsibility for operation. - Pursuant to the provisions of the project document the Reclamation Board of the State of California has given assurances that it will comply with all requirements of local cooperation, which include operation of the project after completion. These assurances were incorporated in an Agreement of Assurances to the Secretary of War, dated 11 March 1947. They were accepted by the Secretary of War on 18 March 1947. By letter dated 19 March 1948 the United States turned over the completed project to the State Reclamation Board for maintenance and operation in accordance with provisions of the authorizing Federal Act. By resolution dated 7 April 1948, the State Reclamation Board accepted the project for maintenance and operation. The Reclamation Board turned the project over to the County of Fresno for maintenance and operation in accordance with the contract and agreement dated 6 August 1946 between the State Reclamation Board and the County of Fresno. The Chief Engineer and General Manager of the Fresno Irrigation District actually operates the project for the County of Fresno.

16. Section 7 of the Flood Control Act of 1944 (58 Stat. 890) requires that the Secretary of War (now Secretary of the Army) shall prescribe regulations for the use of storage allocated for flood control at all reservoirs constructed wholly or in part with Federal funds and that the operation of any such project shall be in accordance with such regulations. Accordingly, regulations have been prepared for printing in the Federal Register and are given in part C of this appendix. The Reclamation Board of the State of California by letter dated 22 July 1953, has concurred in these regulations. By letter dated 31 August 1953, the Reclamation Board has been requested to operate the project in accordance with these regulations pending their publication in the Federal Register.

17. Hydrologic facilities. - Hydrologic facilities used in operation of the project (see charts A-1 and A-2) include four recording stream gaging stations, as follows: Big Dry Creek above Academy (inflow), Big Dry Creek Reservoir above the Big Dry Creek outlet (reservoir level), Big Dry Creek outlet channel below the dam (outflow), and Dog Creek above Dog Creek Outlet (outflow and diversion). There are also five staff gages as follows: Dog Creek below Dog Creek Outlet, Little Dry Creek Outlet Channel below the dam, Little Dry Creek Outlet Channel at the wasteway, Little Dry Creek Outlet Channel at the control section channel, and in the reservoir at the spillway. No precipitation stations are used in operation of the project, and there are none actually within the watershed, but there are nine active precipitation stations in the immediate vicinity around this small area, which can be used to define storm precipitation over the watershed area. In addition to the above facilities, a recording stream gaging station at the location of Staff Gage XII in the Little Dry Creek Outlet Channel and a recording precipitation gage at the dam will be installed during Fiscal Year 1955.

18. Water Rights. - Although there has been no adjudication of water rights on Big Dry or Dog Creeks and there have been no agreements or court action relative to such rights, use has been made of waters of Big Dry and Dog Creeks by land owners along the streams, and the water that has passed the reservoir and diversion site has been utilized in the canals of the Fresno Irrigation District. In order to protect the rights of downstream water users (Fresno Irrigation District), neither the Dog Creek nor the Big Dry Creek Outlet will be completely closed without making proper arrangements with those claiming rights to the water. Operation of the project in accordance with the flood control regulations does not infringe upon any water rights.

19. Downstream channel capacities. - The present capacities of Dog Creek and Big Dry Creek Channels are estimated to be 50 and 150 c.f.s. respectively, but these cannot be utilized during large floods, because during such times they are utilized by flood waters from other areas. The capacity of the Little Dry Creek Outlet Channel is 700 c.f.s., and this capacity can be utilized whenever necessary, as local inflows below the dam are small and generally occur prior to the time releases to Little Dry Creek would be made.

20. Relation to other projects. - In general, the operation of the Big Dry Creek Reservoir and Diversion Project will not materially affect the operation of other projects in the San Joaquin River Basin. It provides reservoir storage space for flood waters that would otherwise have spread over the flood plain area. The tentative regulations for the operation of Friant Reservoir (Millerton Lake) in the interest of flood control require that allowances in releases be made for those flows in Little Dry Creek near Friant which have been diverted from Big Dry Creek Reservoir. During extremely large rain floods it may be necessary to reduce such diversions from Big Dry Creek Reservoir in order not to aggravate flood conditions along San Joaquin River.

21. Pertinent data. - Pertinent data relative to the project are given in the following tabulation:

a. General

Name: Big Dry Creek Reservoir and Diversion

Streams: Dog Creek and Big Dry Creek

Drainage areas:

Dog Creek near Academy	16.6 sq. miles
Big Dry Creek near Academy	69.6 sq. miles
Total at reservoir	86.2 sq. miles
Little Dry Creek Outlet Channel.	5.0 sq. miles
Total for project.	91.2 sq. miles

b. Reservoir

Elevation

Gross pool	425 feet
Spillway flood pool.	430 feet
Taking line.	435 feet

Area

Gross pool	1,530 acres
Spillway flood pool.	1,940 acres
Taking line.	2,390 acres

Storage capacity

Gross pool	16,250 ac.-ft.
Spillway flood pool.	24,900 ac.-ft.
Taking line.	35,700 ac.-ft.

c. Spillway (Unlined channel with concrete sill control section)

Crest length	450 feet
Side slopes.	1 on 1.5
Crest elevation.	425 feet
Discharge at pool elevation 430.	13,300 c.f.s.

PERSONNEL CONCERNED IN FLOOD CONTROL OPERATION OF BIG DRY CREEK RESERVOIR				
	UNIT	OFFICE PHONE	NAME	HOME PHONE
FRESNO IRRIGATION DISTRICT FRESNO, CALIFORNIA	Fresno Irrigation District 1568 Millbrook Fresno, California	209-233-7161	Paul H. Willison Manager Howard Keck Engineer	209-229-5101 209-299-7537 (Clovis)
STATE OF CALIFORNIA SACRAMENTO, CALIFORNIA	Reclamation Board 1100 "O" Street Sacramento, California	916-445-9454	A. E. McCollam General Manager Howard S. Hitchcock Asst. Chief Engineer	916-967-4258
DEPARTMENT OF THE ARMY SACRAMENTO DISTRICT CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA	District Engineer Reservoir Regulation Hydrology State Flood Center Liaison	916-449-2232* 916-449-2378* 916-449-3167* 916-449-3168* 916-449-2517* 916-449-3577	Col. George B. Fink District Engineer R. P. Leatham Chief, Res. Reg. Unit R. E. Bennion Chief, Hydrology Section	916-483-2010 916-456-9942
FTS: Sacramento 916-449-2000; Fresno 209-485-5000				
*NOTE: Between 4:30 p.m. and 7:45 a.m., or on Saturday, Sunday, or Holidays use 916-452-1535 (Flood Season Only)				
Big Dry Creek Reservoir, Fresno County, California			C.D.M.	Rev. Feb. 1969

12. Modification of regulations. - The official regulations are subject to temporary modification during flood or other emergencies by the District Engineer, Corps of Engineers. Permanent changes in the regulations require the approval of the Secretary of the Army and publication in the Federal Register.

13. Operation reports. - Whenever the reservoir level is above 405 feet, the reservoir operator shall report, by telephone as early as practicable each work day and at other times upon request, to the Reservoir Regulation Section of the Sacramento District, Corps of Engineers, the following data:

- a. Reservoir stage and storage.
- X b. Precipitation at dam (after gage is installed).
- c. Gate settings since the previous report at:
 - (1) Dog Creek outlet.
 - (2) Big Dry Creek outlet.
 - (3) Little Dry Creek outlet.
- d. Flows since the previous report at:
 - X (1) Big Dry Creek at Academy.
 - X (2) Dog Creek below the outlet.
 - ✓ (3) Dog Creek Diversion.
 - X (4) Big Dry Creek below the reservoir.
 - X (5) Little Dry Creek outlet channel below the reservoir.
 - (6) Little Dry Creek outlet channel at the concrete control section.
 - (7) Spillway discharge.
 - (8) Wasteway discharge.

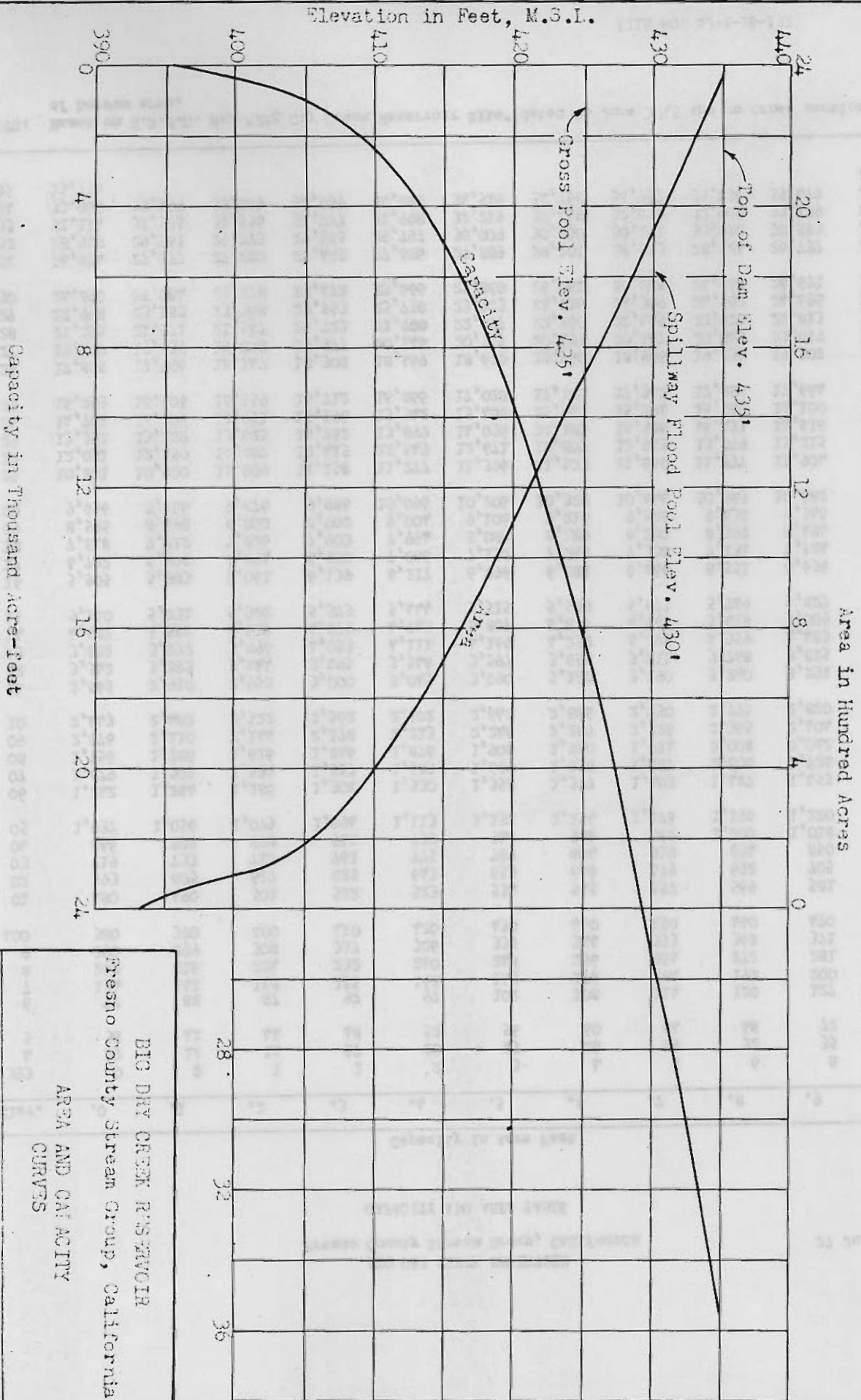
14. Immediately after the end of each month, the operating agency shall dispatch to the Reservoir Regulation Section of the Corps of Engineers a summary for the month of the data outlined in the previous paragraph.

see March 1942 Report on next page

15. The District Engineer shall prepare monthly operation reports and other special reports relative to the operation as required by the Chief of Engineers.

16. Examples of operation. - The manner in which the project would operate during the occurrence of the reservoir design flood, the worst flood of record (that of March 1938), and of the spillway design flood is illustrated on charts B-1, B1.1, and B-2. In these examples, no releases are made to Dog and Big Dry Creeks during the floods, as space in downstream canals is reserved for runoff from Redbank and Fancher Creeks.

17. Operation record. - The official operation record of Big Dry Creek Reservoir and Diversion is the monthly report of operations submitted by the operating agency to the District Engineer. A brief summary of operations to date is shown on chart B-3.



File No. SD-1-26-130

CORPS OF ENGINEERS, SACRAMENTO, CALIF.
Prepared: A.G.C. 30 June 1953

BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California
AREA AND CAPACITY
CURVES

BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California

27 July 1953

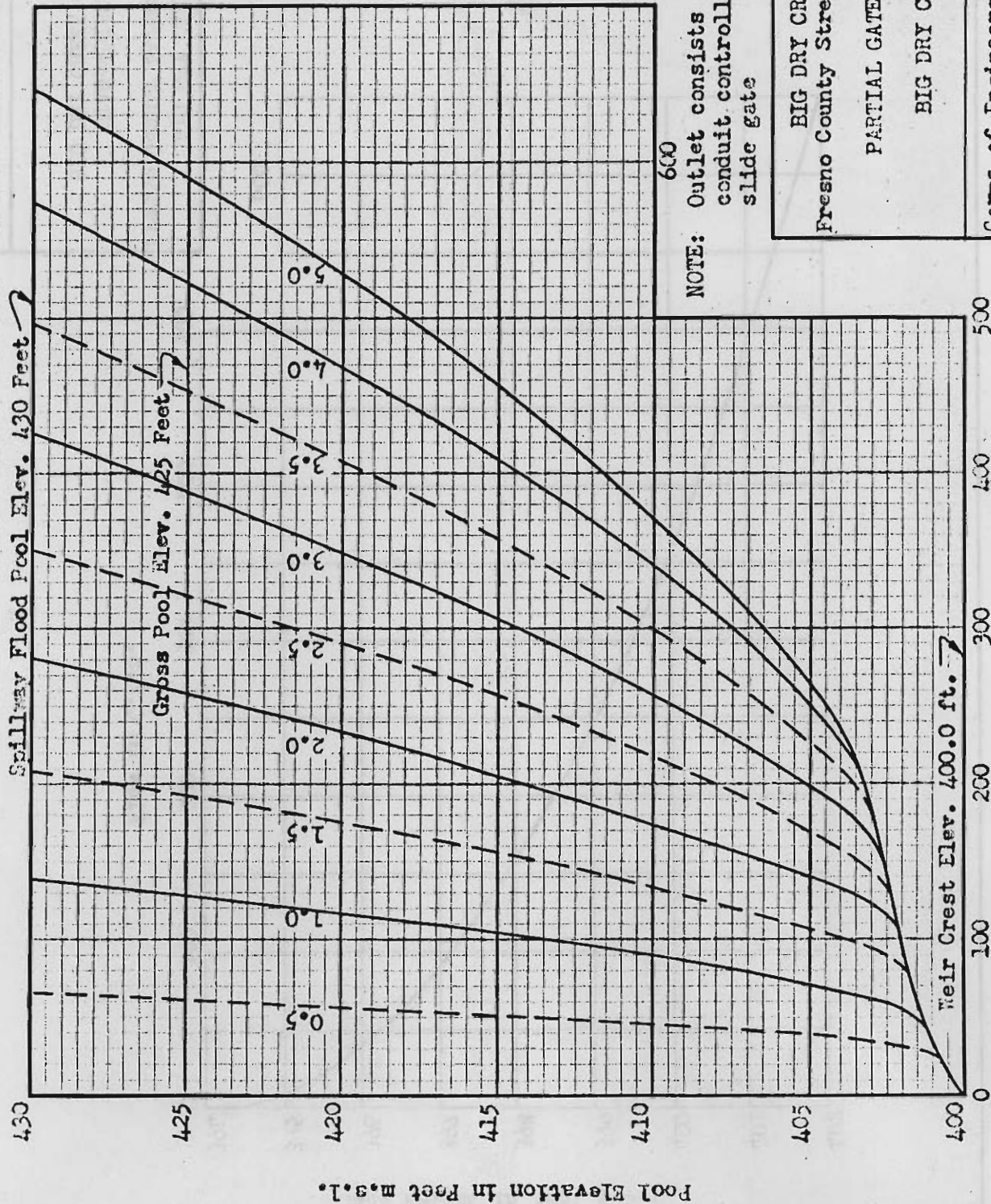
CAPACITY AND AREA TABLE

Elev.	Capacity in Acre Feet										Area in
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	Acres
393	0	0	1	1	2	3	4	5	6	8	0
4	10	12	14	17	20	23	26	29	32	35	20
5	38	41	44	48	52	56	60	64	68	72	34
6	77	82	87	92	97	102	108	114	120	127	46
7	134	141	148	155	162	169	176	184	192	200	67
8	208	216	224	232	240	248	256	264	272	281	79
9	290	299	308	317	326	335	344	353	362	371	87
400	380	390	400	410	420	430	440	450	460	470	95
01	480	490	501	512	523	534	545	557	569	581	104
02	593	605	617	629	641	653	666	679	692	705	119
03	719	733	747	761	775	789	804	819	834	850	136
04	866	882	898	914	930	946	964	982	1,000	1,018	157
05	1,037	1,056	1,075	1,094	1,113	1,132	1,154	1,176	1,198	1,220	186
06	1,242	1,264	1,286	1,308	1,330	1,352	1,377	1,402	1,427	1,453	220
07	1,479	1,505	1,531	1,557	1,583	1,609	1,638	1,667	1,696	1,726	257
08	1,756	1,786	1,816	1,846	1,876	1,906	1,940	1,974	2,008	2,042	297
09	2,076	2,110	2,144	2,178	2,213	2,248	2,287	2,326	2,365	2,404	342
10	2,443	2,482	2,522	2,562	2,602	2,642	2,686	2,730	2,775	2,820	394
11	2,865	2,910	2,955	3,000	3,045	3,090	3,140	3,190	3,240	3,291	448
12	3,342	3,393	3,444	3,495	3,546	3,597	3,654	3,711	3,768	3,825	507
13	3,882	3,939	3,996	4,053	4,111	4,169	4,232	4,295	4,359	4,423	572
14	4,487	4,551	4,615	4,679	4,743	4,807	4,877	4,947	5,018	5,089	638
15	5,160	5,231	5,302	5,373	5,444	5,515	5,593	5,671	5,749	5,827	708
16	5,905	5,983	6,061	6,139	6,217	6,296	6,381	6,466	6,551	6,636	781
17	6,722	6,808	6,894	6,980	7,066	7,152	7,245	7,338	7,431	7,524	856
18	7,618	7,712	7,806	7,900	7,994	8,088	8,189	8,290	8,392	8,494	936
19	8,596	8,698	8,800	8,902	9,004	9,106	9,216	9,326	9,436	9,546	1,018
20	9,656	9,766	9,876	9,986	10,096	10,206	10,325	10,444	10,563	10,682	1,100
21	10,801	10,920	11,039	11,158	11,277	11,396	11,523	11,650	11,777	11,904	1,190
22	12,031	12,159	12,287	12,415	12,543	12,671	12,807	12,943	13,079	13,215	1,275
23	13,351	13,488	13,625	13,762	13,899	14,036	14,181	14,326	14,471	14,616	1,365
24	14,761	14,906	15,051	15,196	15,342	15,488	15,641	15,794	15,947	16,100	1,452
25	16,253	16,406	16,559	16,712	16,866	17,020	17,181	17,342	17,503	17,664	1,532
26	17,825	17,986	18,147	18,308	18,469	18,630	18,798	18,966	19,134	19,302	1,610
27	19,470	19,639	19,808	19,977	20,146	20,315	20,491	20,667	20,843	21,019	1,685
28	21,195	21,371	21,547	21,723	21,900	22,077	22,261	22,445	22,629	22,813	1,762
29	22,998	23,183	23,368	23,553	23,738	23,923	24,116	24,309	24,502	24,696	1,846
30	24,890	25,084	25,278	25,472	25,666	25,860	26,062	26,265	26,468	26,671	1,937
31	26,874	27,077	27,280	27,483	27,686	27,889	28,101	28,313	28,525	28,737	2,029
32	28,949	29,161	29,373	29,585	29,797	30,009	30,230	30,451	30,672	30,893	2,120
33	31,114	31,335	31,556	31,777	31,998	32,219	32,449	32,679	32,909	33,139	2,210
34	33,369	33,599	33,829	34,059	34,289	34,519	34,758	34,997	35,236	35,475	2,300
435	35,714										2,390

NOTE: Based on U.S.E.D. Map "Big Dry Creek Reservoir Site" dated 26 June 1945 and on cross sections of borrow area.

FILE NO. SJ-1-26-131

CHART A-6

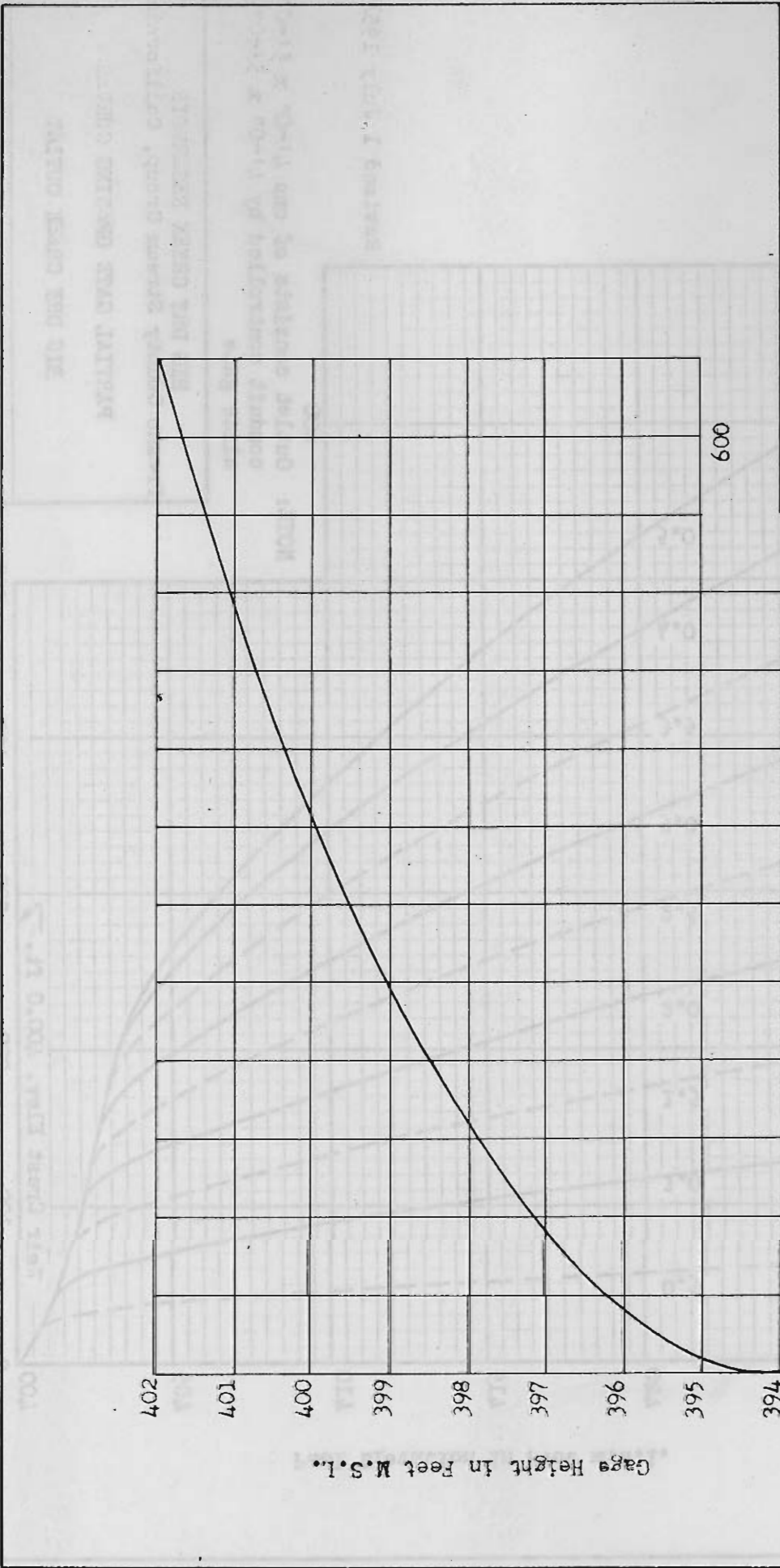


Revised 1 July 1954

600

BIG DRY CREEK RESERVOIR
Presno County Stream Group, California
PARTIAL GATE OPENING CURVES
BIG DRY CREEK OUTLET

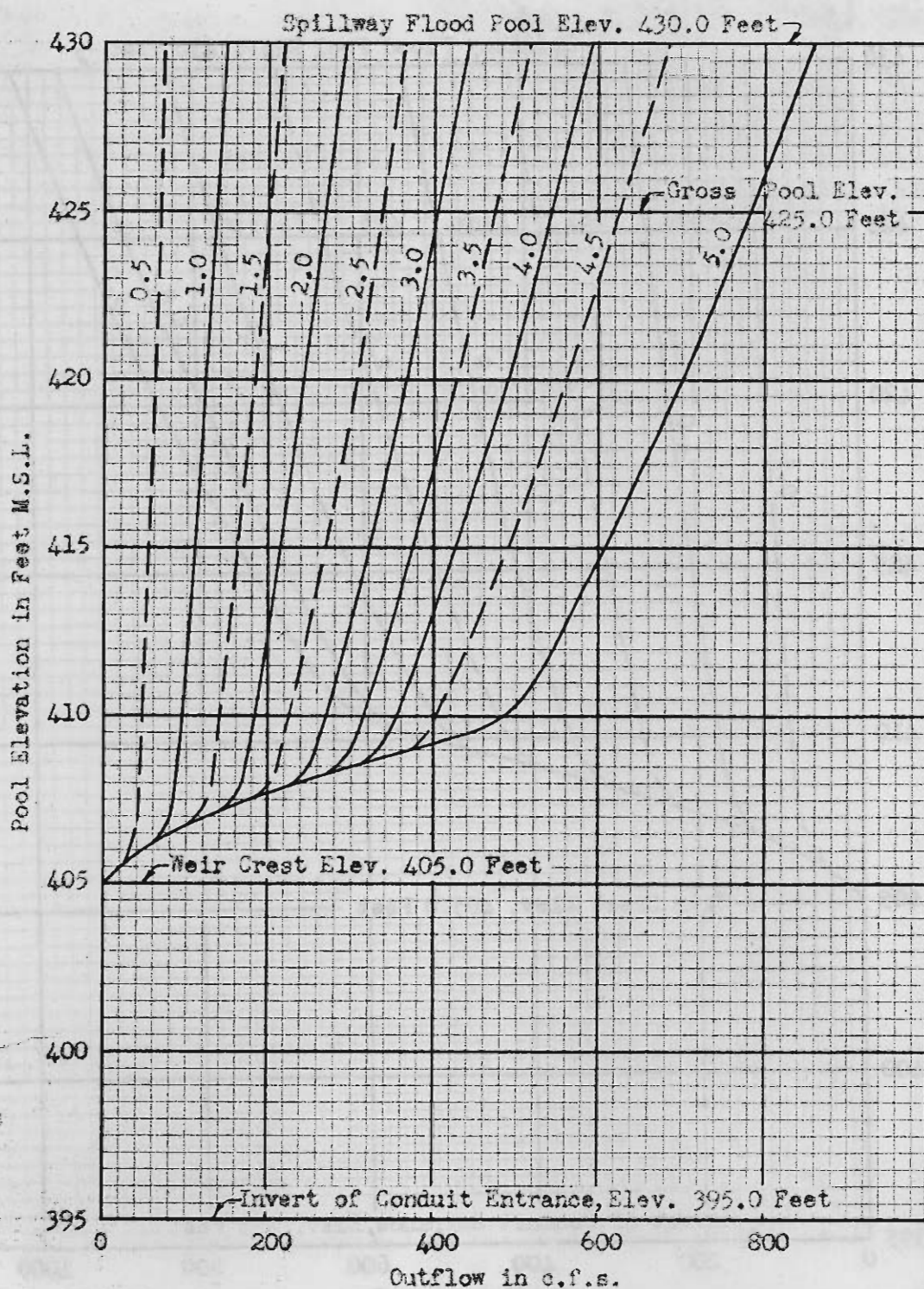
Corps of Engineers Sacramento, Calif.
Prepared by A.E.C. 9 April 1954



BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California

STAGE-DISCHARGE CURVE
BIG DRY CREEK OUTLET CHANNEL

Corps of Engineers Sacramento, Calif.
Prepared by A.G.C. 8 April 1953
CHART A-8



NOTE:

Outlet consists of one 6'-0" x 5'-0" conduit controlled by two 4'-0" x 5'-0" slide gates.

BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California

PARTIAL GATE OPENING CURVES
LITTLE DRY CREEK OUTLET

ONE GATE ONLY
(OTHER GATE CLOSED)

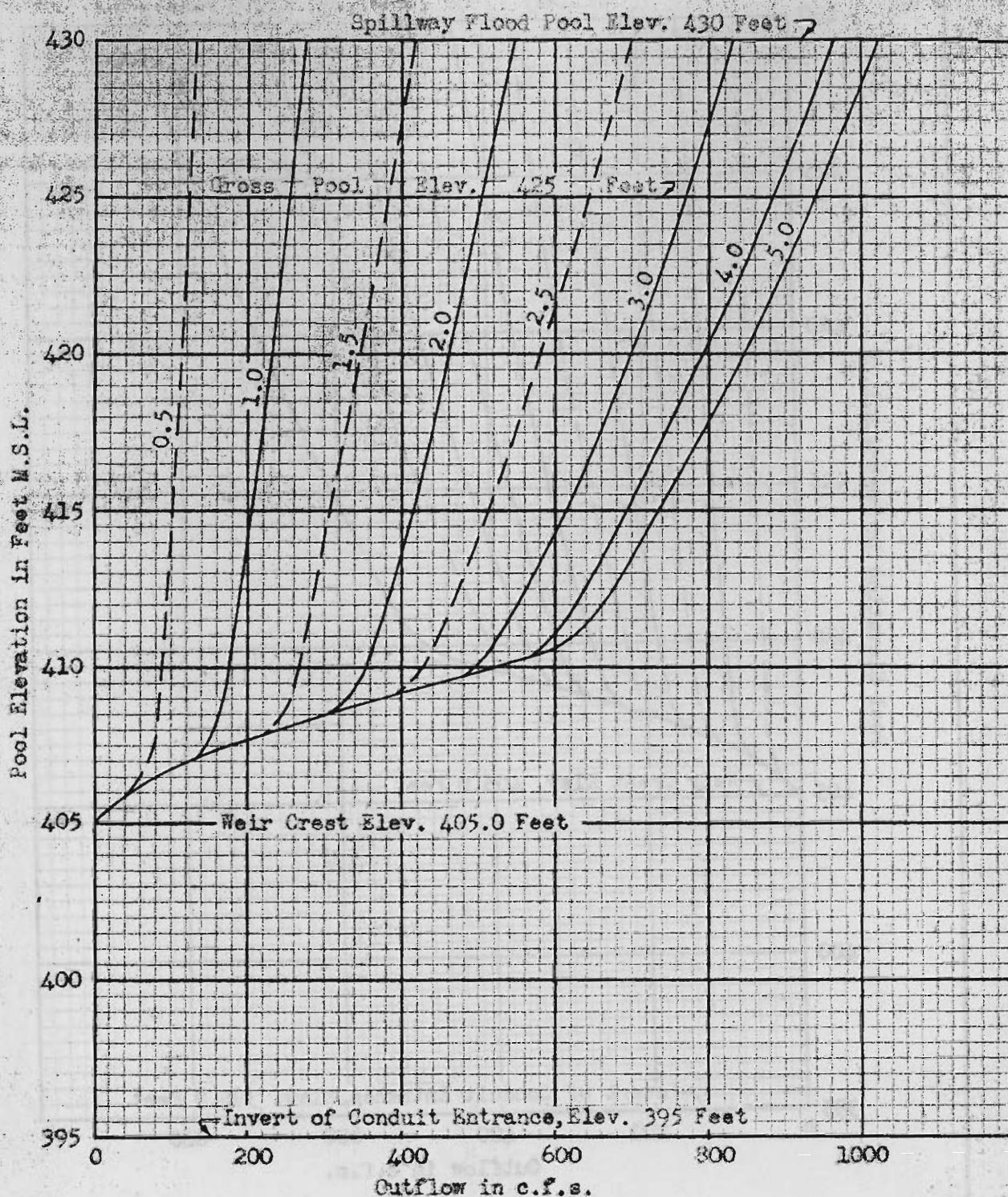
Corps of Engineers Sacramento, Calif.

Prepared by A.G.C.

20 May 1953

File No. SJ-1-26-134

CHART A-9



NOTE:

Outlet consists of one 6'-0" x 5'0" conduit controlled by two 4'0" x 5'0" slide gates.

BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California

PARTIAL GATE OPENING CURVES
LITTLE DRY CREEK OUTLET
TWO GATES OPERATING SIMULTANEOUSLY
(Identical openings)

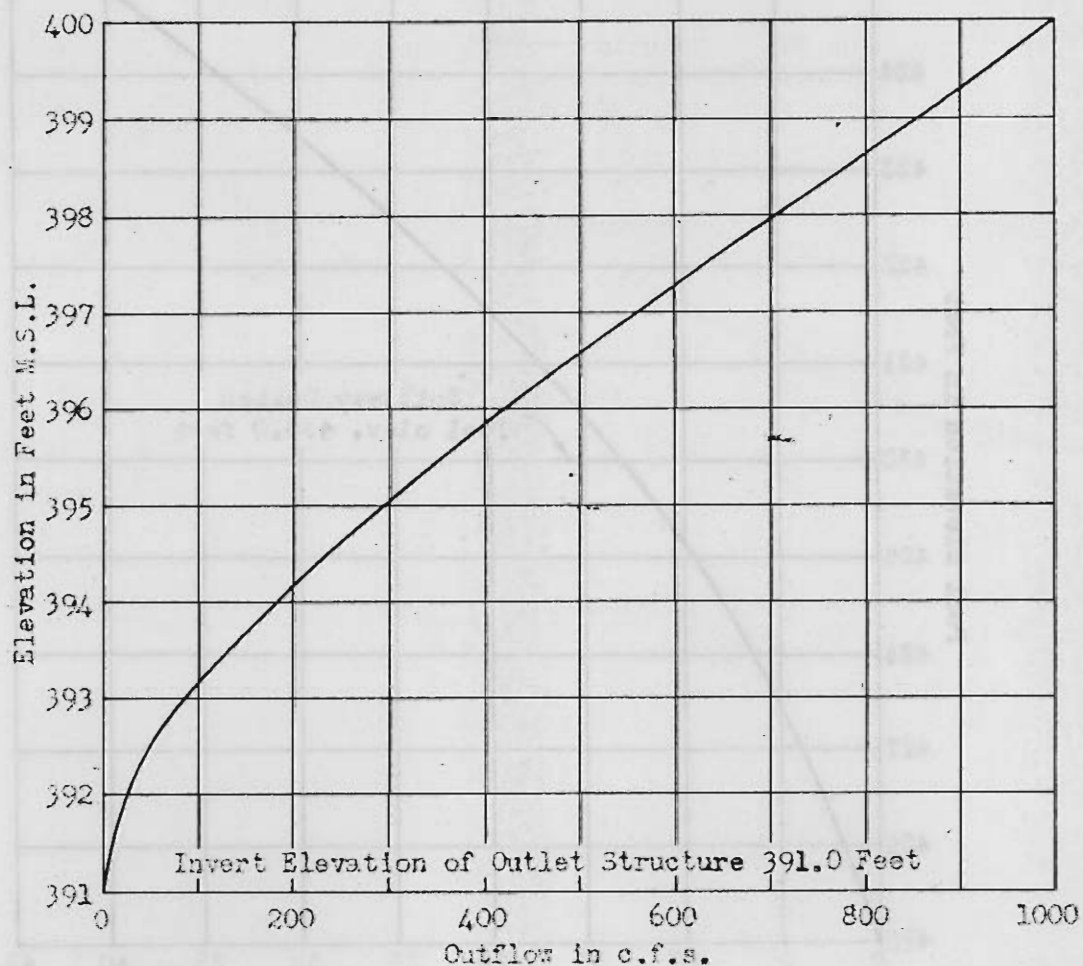
Corps of Engineers Sacramento, Calif.

Prepared by A.G.C.

9 April 1953

File No. SJ-1-26-135

CHART A-10



BIG DRY CREEK RESERVOIR
 Fresno County Stream Group, California
 STAGE-DISCHARGE CURVE
 LITTLE DRY CREEK OUTLET CHANNEL
 BELOW LITTLE DRY CREEK OUTLET
 (Staff Gage X)

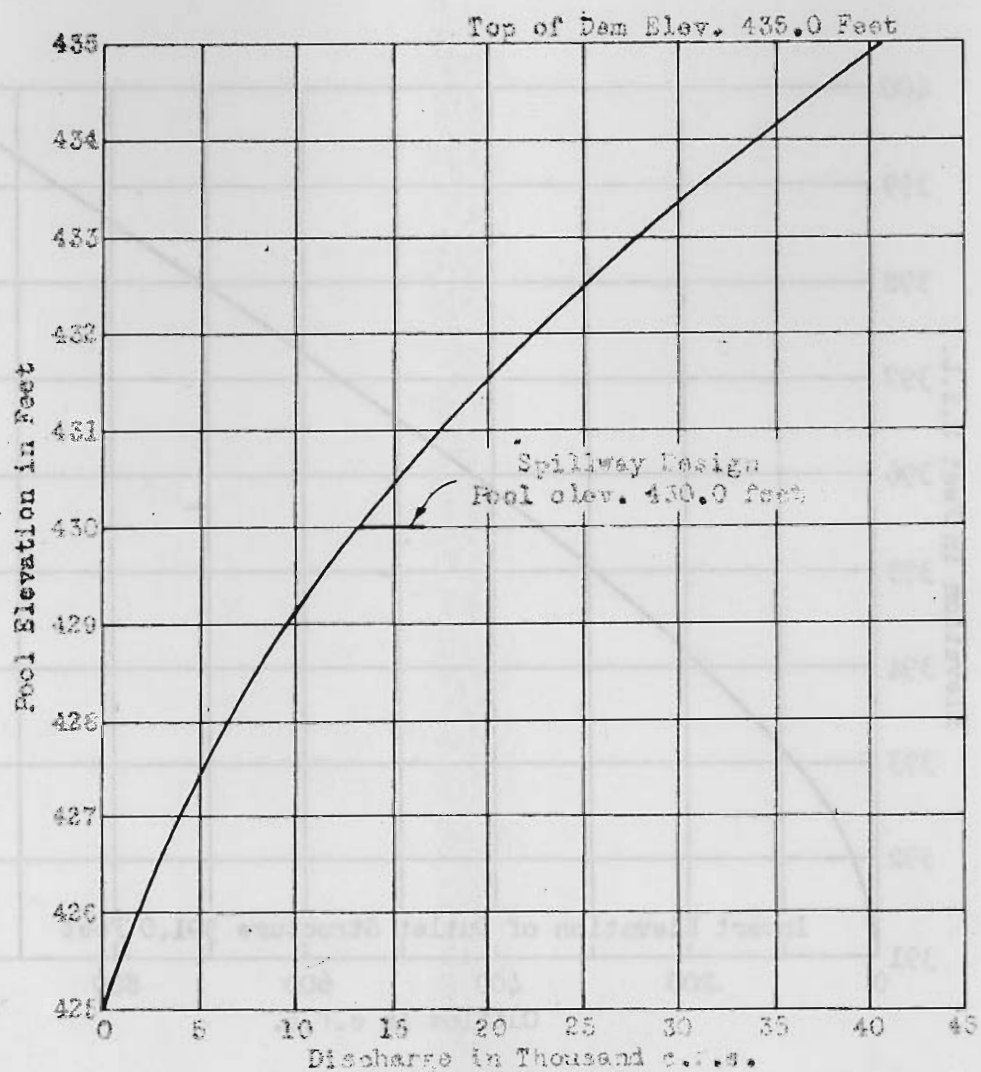
Corps of Engineers Sacramento, Calif.

File No. SJ-1-26-136

Prepared by A.G.C.

20 May 1953

CHART A-11



BIG DRY CREEK RESERVOIR
Fresno County Stream Group, Calif.

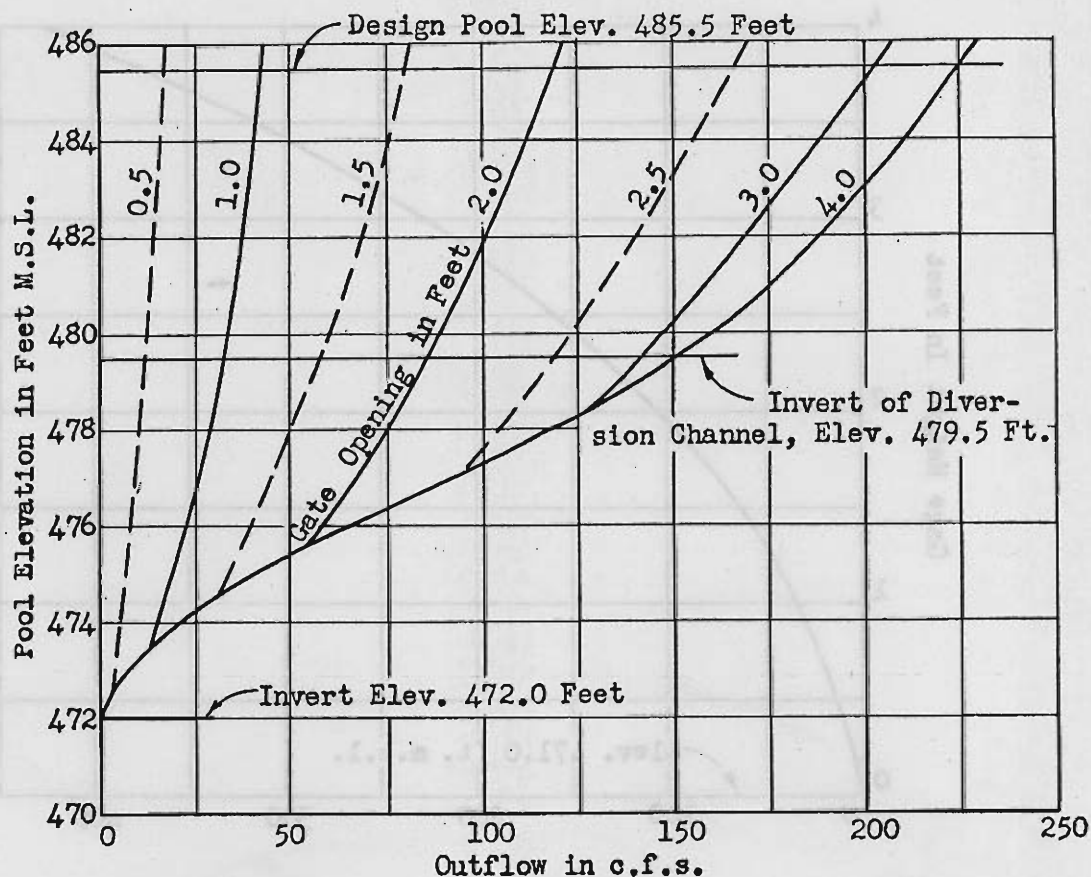
SPILLWAY RATING CURVE

Corps of Engineers, Sacramento, Calif.

Prepared: A.G.C. Date: 9 April 1953

File No. SJ-1-26-137

CHART A-12



NOTE: Outlet consists of two 48"-dia. conduits controlled by slide gates.

BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California

PARTIAL GATE OPENING CURVES
DOG CREEK OUTLET

Flow Through Each Conduit

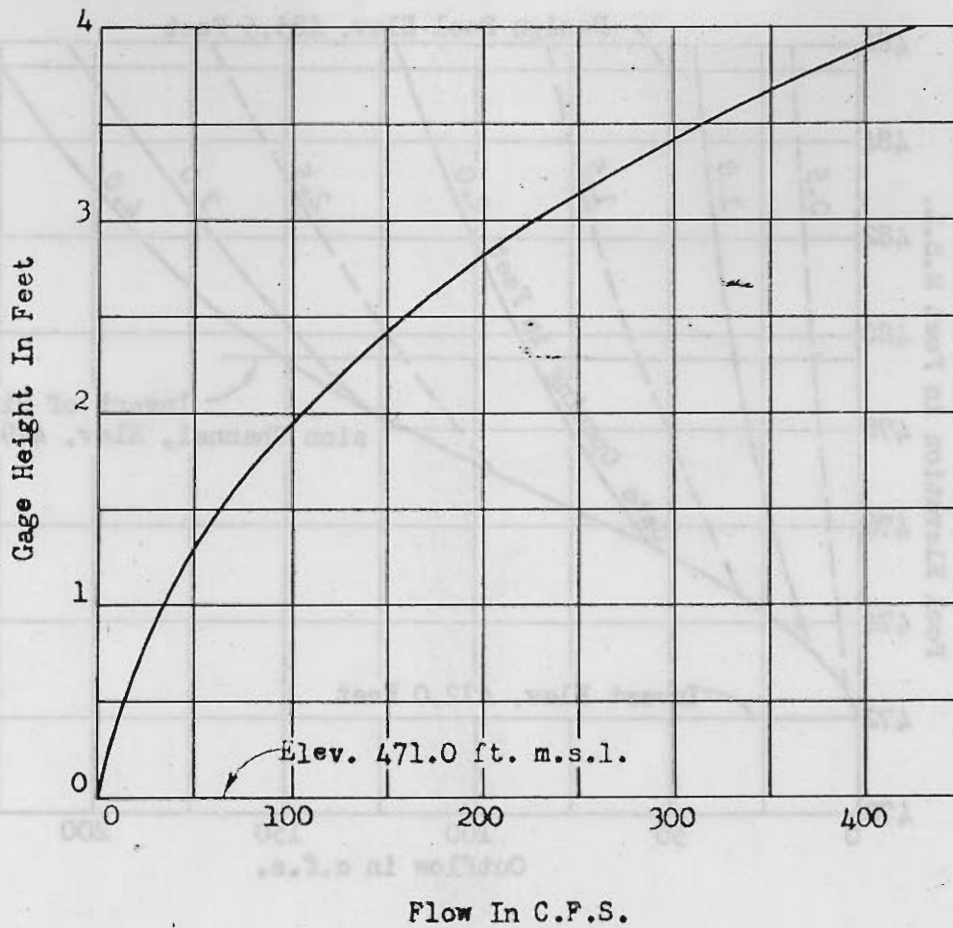
Revised 1 July 1954
File No. SJ-1-26-138

Corps of Engineers Sacramento, Calif.

Prepared by A.G.C.

9 April 1953

CHART A-13



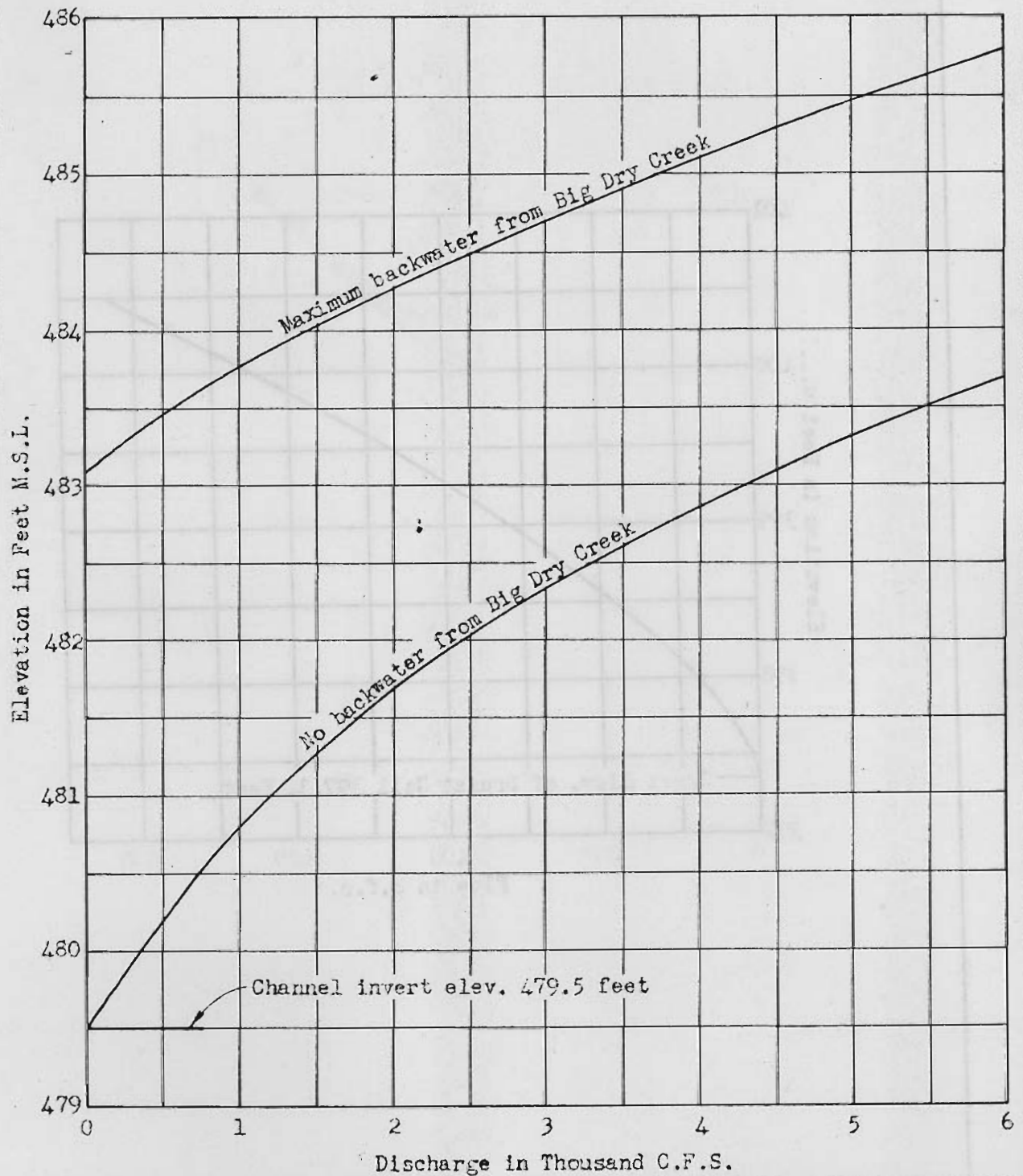
BIG DRY CREEK RESERVOIR
 Fresno County Stream Group, California

STAGE-DISCHARGE CURVE
 DOG CREEK BELOW
 DOG CREEK OUTLET STRUCTURE

Corps of Engineers Sacramento, Calif.
 Prepared by AGC 8 April 1953

File No. SJ-1-26-139

CHART A-14



BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California

STAGE-DISCHARGE CURVES
DOG CREEK DIVERSION CHANNEL

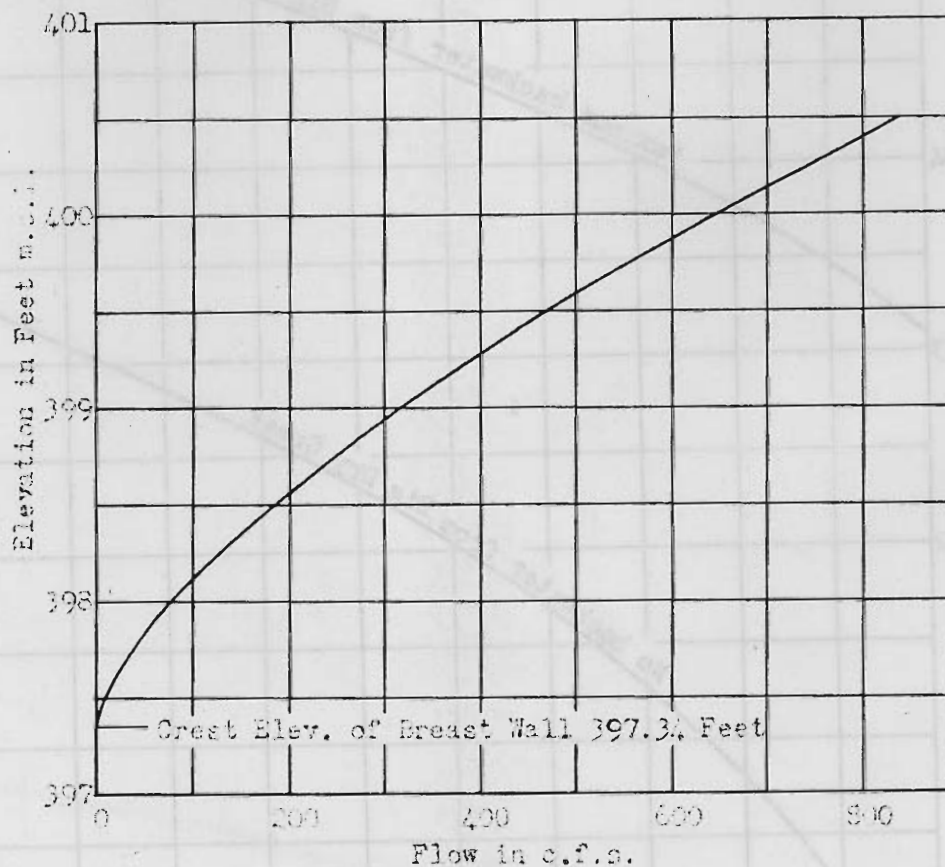
Corps of Engineers Sacramento, Calif.

File No. SJ-1-26-140

Prepared by A.G.C.

29 May 1953

CHART A-15

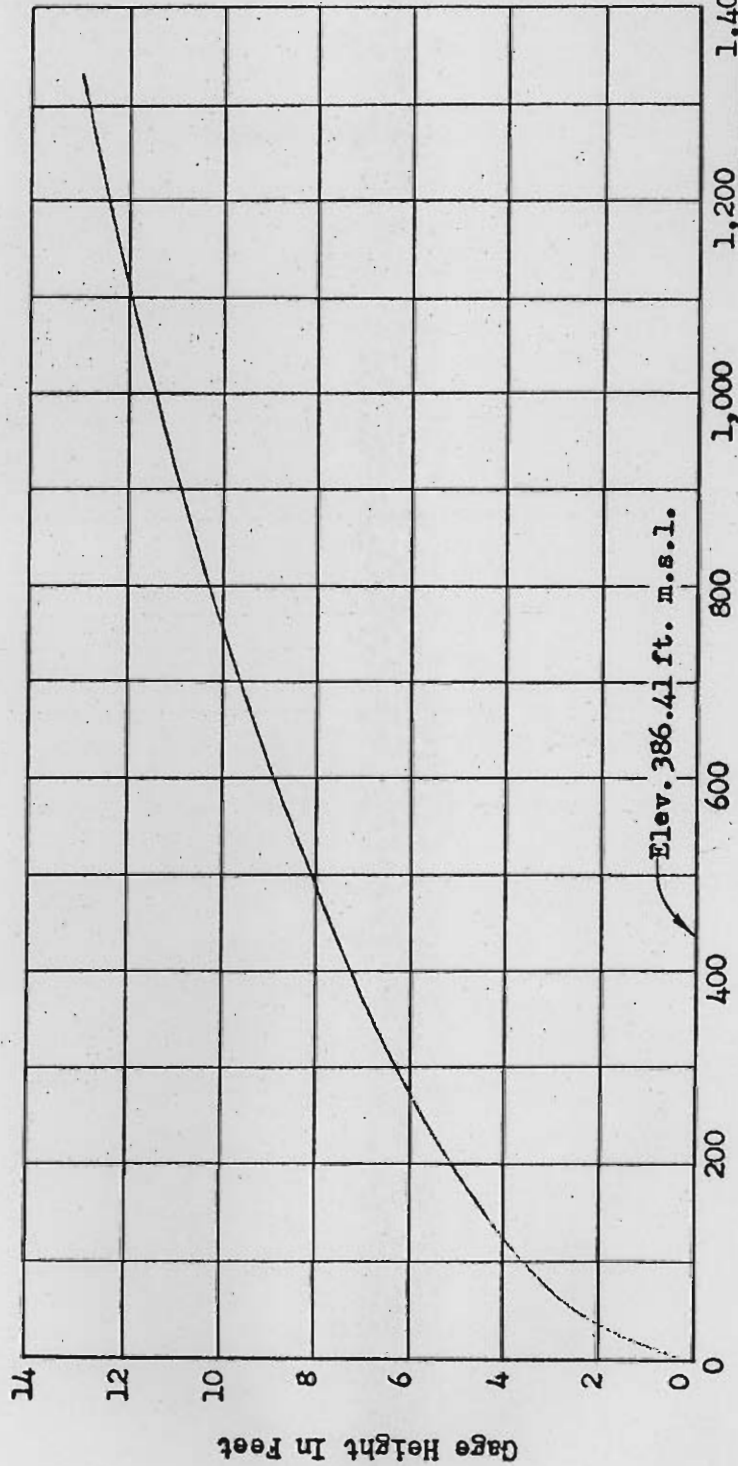


BIG DRY CREEK RESERVOIR
 Fresno County Stream Group, California
 STAGE-DISCHARGE CURVE
 WASTEWAY THROUGH DIKE
 ALONG LITTLE DRY CREEK OUTLET CHANNEL
 (Staff Gage XIII)

Corps of Engineers Sacramento, Calif.
 Prepared by A.G.C. 20 May 1953

Revised 1 July 1954
 File No. SJ-1-26-141

CHART A-16



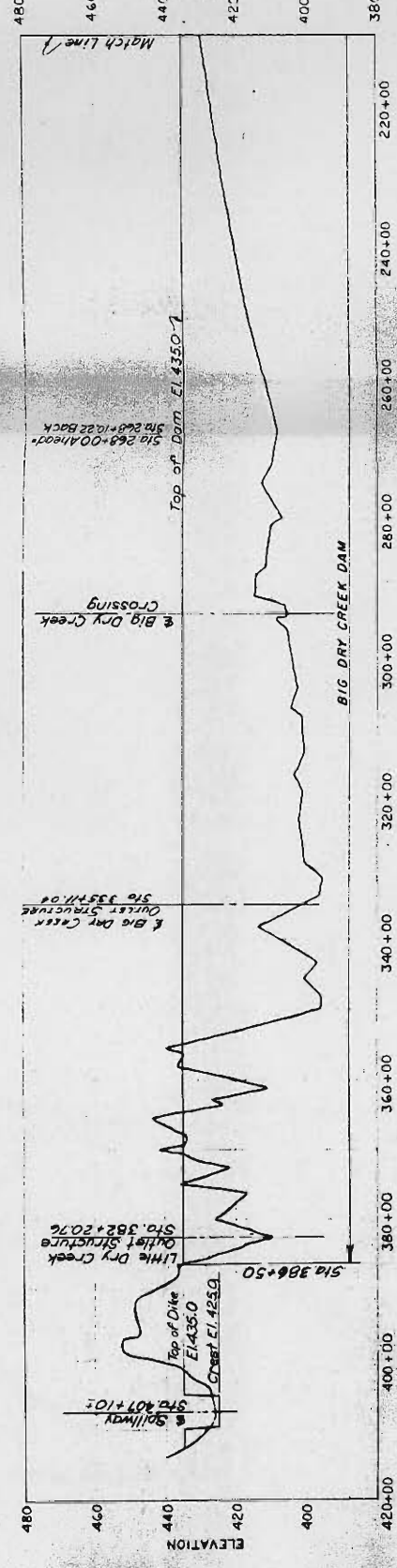
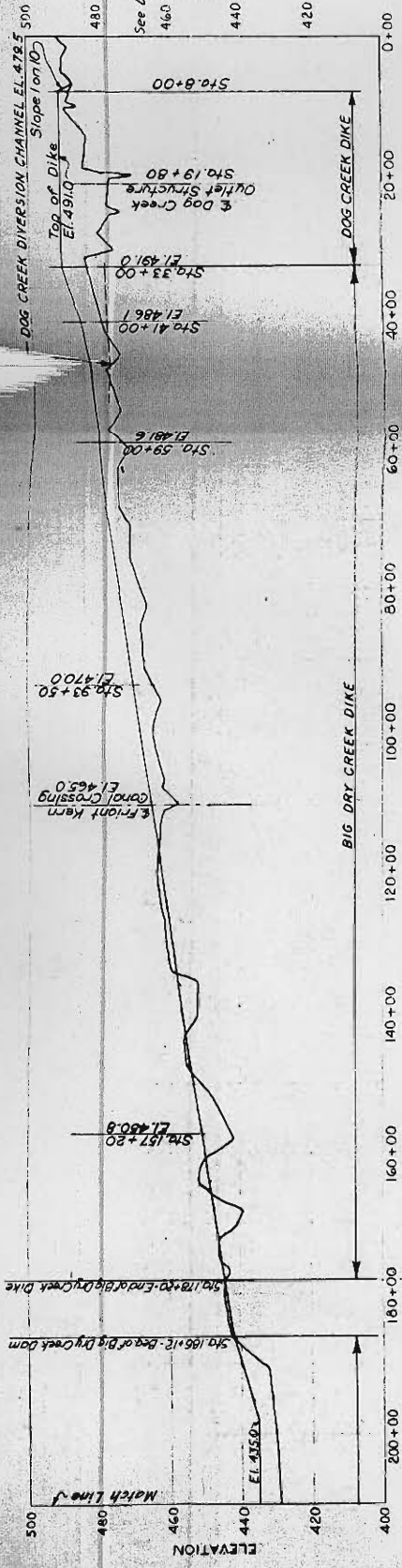
Flow in C.F.S.

BIG DRY CREEK RESERVOIR
Fresno County Stream Group, California
STAGE-DISCHARGE CURVE
LITTLE DRY CREEK OUTLET CHANNEL
AT CONCRETE CONTROL SECTION
(Staff Gage XII)

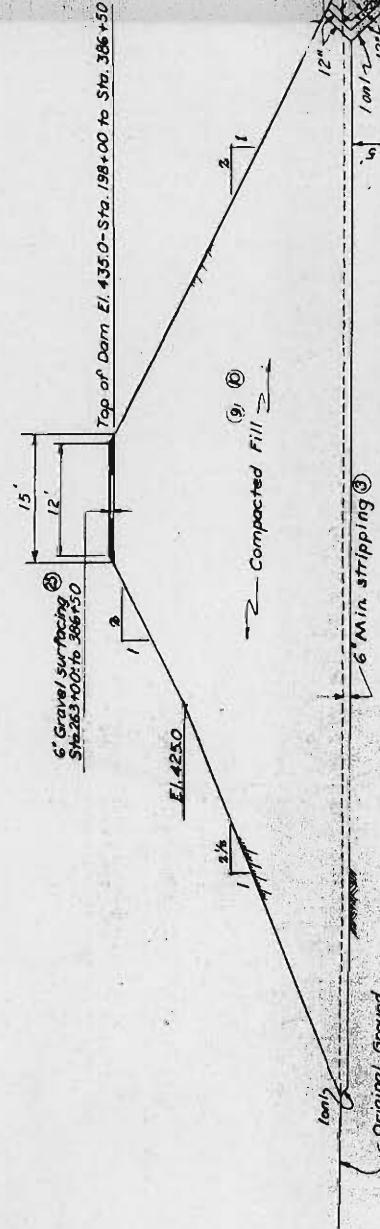
Revised 1 July 1954
File No. SJ-1-26-142

Corps of Engineers Sacramento, Calif.
Prepared by A.G.C. 8 April 1953

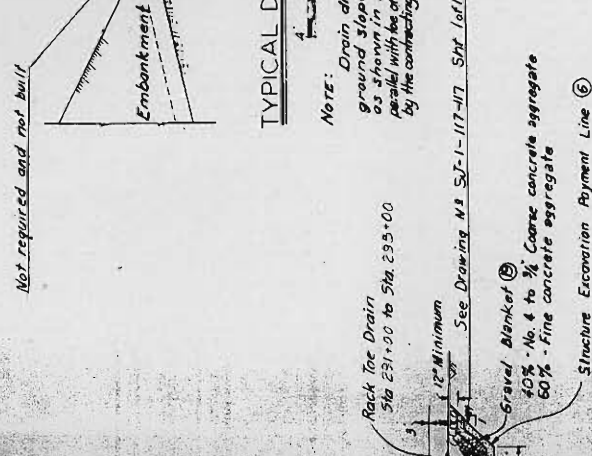
CHART A-17



PROFILE ON $\frac{1}{2}$ OF DAM



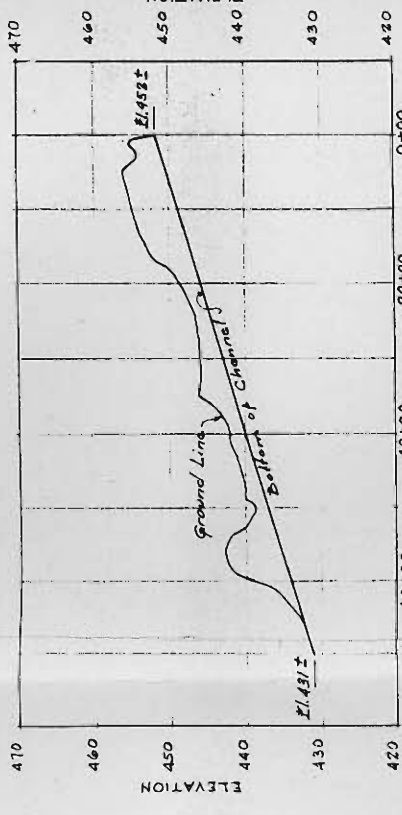
TYPICAL DAM SECTION



TYPICAL DRAIN DITCH SECTION

Note: Drain ditch required wherever natural ground slopes toward toe of embankment as shown in section wherever slope of natural ground parallel with toe of embankment exceeds 6% and as directed by the contracting officer.

PROFILE ON $\frac{1}{2}$ OF BIG DRY CREEK EXCAVATED CHANNEL



TYPICAL SECTION BIG DRY CREEK EXCAVATED CHANNEL

GENERAL NOTES

Figures in circles indicate item number under which payment will be made.
For Profile of Little Dry Creek Dike and Channel see sheet II.

AS CONSTRUCTED

FRESNO COUNTY STREAM GROUP, CALIFORNIA
BIG DRY CREEK RESERVOIR
PROFILES AND SECTIONS

Corps of Engineers	Scales as shown
Prepared by: A.G.C.	Sacramento, California
28 May 1953	

PART B

OPERATION

BIG DRY CREEK RESERVOIR AND DIVERSION
FRESNO COUNTY STREAM GROUP, CALIFORNIA

24 August 1953

(Revised 1 July 1954)

PART B

OPERATION

BIG DRY CREEK RESERVOIR AND DIVERSION
FRESNO COUNTY STREAM GROUP, CALIFORNIA

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9	Duties of reservoir operator	4
12	Modification of regulations	7
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17	Operation record	8

LIST OF CHARTS

<u>Chart No.</u>	<u>Subject</u>
B-1	Reservoir Design Flood Routing
B-1.1	Hypothetical Operation, Flood of March 1938
B-2	Spillway Design Flood Routing
B-3	Operation Record Big Dry Creek Reservoir and Diversion

PART B
OPERATION

BIG DRY CREEK RESERVOIR AND DIVERSION
FRESNO COUNTY STREAM GROUP, CALIFORNIA

1. Operational requirements.—Big Dry Creek Reservoir and Diversion will be operated for flood control in accordance with the regulations contained in Part C of this appendix to achieve the following objectives:

a. To restrict flows in downstream channels and distributaries of Dog Creek and Big Dry Creek to non-damaging rates.

b. To divert all excess flood waters temporarily stored in Big Dry Creek Reservoir through Little Dry Creek outlet channel at maximum rates up to the safe capacity of the outlet channel as determined at the wasteway and at the drop structures, until all flood control space is again available.

c. To accomplish objectives a and b above without infringing on water rights on either Big Dry Creek or Dog Creek.

2. In achieving the above objectives, forecasting of flood flows will not be important, since the release from the reservoir is small in comparison with the volume of the design flood (standard project flood), and the few hours gained by a forecast would not materially affect the quantity of storage in the reservoir. As there may be considerable local inflow between the reservoir and the wasteway in the Little Dry Creek outlet channel, maintaining channel capacity flows at the wasteway may require frequent manipulation of the outlet gates and observation of the water level at the wasteway during large storms.

3. Project document operation plan. - The operation plan proposed in the project document is quoted from that document as follows:

"Operation of the improvement would allow the normal flows of Big Dry Creek and Dog Creek to continue downstream in their natural channels. Provision is made for retarding or diverting these flows if it is so desired by local interests. Minor and moderate flood flows would be held in the reservoir until they can be released into the downstream channel of Big Dry Creek without causing overbank flows. Major floods would be diverted into Little Dry Creek and thence into the San Joaquin River."

4. Definite project report operation plan. - The operation plan as published in the Revised Definite Project Report for Big Dry Creek Reservoir and Diversion, dated October 1945, is quoted from that document as follows:

"The project is designed to protect Fresno and adjacent areas from damaging floods from Fresno County streams, by controlling flows on Big Dry and Dog Creeks. Under present conditions, flood flows on streams of the Fresno County group, other than Big Dry and Dog Creeks, would be safely carried in the existing network of channels when the network is relieved of excess flow from Big Dry Creek and Dog Creek by operation of the project. Normal flows in Dog Creek and Big Dry Creek will pass downstream in their natural channels. When flows approach or reach quantities which will cause flood damage at any downstream point, excess flow, or the entire flow in Dog Creek will be diverted into Big Dry Creek and the Big Dry Creek Outlet will be throttled to reduce the discharge from the reservoir as required. The stored water may be released through Big Dry Creek outlet at non-damaging rates as soon as downstream conditions permit. Reservoir storage may be used for conservation purposes from May to October provided a minimum of 5,000 acre-feet of storage is available for flood control at all time. From November to April, the reservoir will be completely emptied and the entire storage space reserved for flood control. A gross storage of 15,500 acre-feet will be available for this purpose. During major floods, all flow in Dog Creek will be diverted into Big Dry Creek, and all inflow to the reservoir will be retained in the reservoir until the water surface rises to minimum pool elevation 405. Additional flows in the streams, which cause a further rise of the reservoir water surface, will be discharged through Little Dry Creek outlet into the channel leading into Little Dry Creek. Flows through the channel to Little Dry Creek will be restricted to a maximum of about 700 c.f.s. by manipulation of the gates at the Little Dry Creek outlet structure. Since the local drainage into the canal is usually small, and occurs prior to the filling of the reservoir, it will usually be possible to release about 700 c.f.s. from the reservoir throughout most of the flood period."

5. Departure from Definite Project Report. - The present plan differs from the Definite Project Report operation plan only in that the present plan allows no space to be used for conservation purposes while the Definite Project Report plan reserved a minimum of 5,000 acre-feet of flood-control space from May to October, the rest of the reservoir space during that period being available for conservation purposes. Because the easements which have been acquired in Big Dry Creek Reservoir are for flood control purposes only, use of any storage space for conservation cannot be allowed.

6. Limitations on storage. - The entire storage of Big Dry Creek Reservoir is reserved for flood-control purposes.

7. Limitations on releases. - The Dog Creek and Big Dry Creek outlets are used primarily for passing normal flows of those creeks through the project for downstream irrigation use. In general, these outlets are completely closed during major floods, when there is little or no downstream use and any releases would aggravate flooding by other streams entering the flood plain area. Except during periods of heavy flooding, about 50 cubic feet per second can be safely released to Dog Creek and about 150 cubic feet per second can be safely released to Big Dry Creek. These outlets are partially opened only after the flood threat has passed and there is again downstream capacity and use. In contrast, the Little Dry Creek Outlet is used entirely for diverting floodwaters during flood periods and for subsequently releasing impounded floodwater that cannot be released down Big Dry Creek. This outlet is ordinarily kept open and is throttled only when the reservoir stage is so high that an uncontrolled release would exceed the capacity of the outlet channel. As the flow in the outlet channel may be a combination of local inflow, outlet release, and spillway release, it is essential that the stages at the wasteway be observed frequently during critical periods so that releases through Little Dry Creek outlet can be modified promptly as required to compensate for spillway or local flows. By the time the spillway release is equal to the channel capacity at the wasteway, the Little Dry Creek outlet should be completely closed. At such times, it may be desirable to somewhat increase flood releases through the Dog Creek and Big Dry Creek outlets in order to reduce flows through the wasteway or to prevent failure of the Little Dry Creek outlet dike if this can be accomplished without causing serious flooding below these outlets. In the rare event that the reservoir level reaches elevation 430, safety of the structure requires that all outlets be fully opened and remain open until the reservoir level recedes below elevation 430.

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8. Schedule of operation. - The schedule of operation of Big Dry Creek Reservoir and Diversion Project is summarized as follows:

a. When the reservoir water level is below the spillway crest elevation:

- (1) Restrict releases through Big Dry Creek and Dog Creek

outlets, as necessary, to the small flood flows which can be used, diverted, or otherwise disposed of in downstream areas. During major floods when large volumes of floodwater are entering this downstream area from other streams, these released may be very small.

(2) Maintain releases through Little Dry Creek outlet at the maximum that can be passed without causing exceedance of the capacity of the channel at the wasteway (about 700 c.f.s including local inflow) or causing structural damage at the drop structures in the lower end of the channel. At very rare intervals it may be necessary to reduce this release, on an emergency basis, because of serious flood conditions along San Joaquin River into which this diverted floodwater passes.

b. When the reservoir water level is above the spillway crest elevation:

(1) Increase releases insofar as practicable, to the maximum which can be passed downstream without causing serious over-bank flooding. In the event that spillway and local flows into the Little Dry Creek outlet channel are so large that they cannot be compensated for by closing the Little Dry Creek outlet and there is flow over the wasteway on that channel, releases through Big Dry Creek and Dog Creek outlets may be further increased with resultant downstream damage if thereby the overall damage to the downstream area is reduced.

(2) Continue to maintain releases through the Little Dry Creek outlet at the maximum capacity of the outlet channel, insofar as possible, by progressive closing of the outlet as the bypassing spillway flow increases.

c. When the water surface is above elevation 430:

(1) Open all outlets wide until the water surface elevation drops below elevation 430.

9. Duties of reservoir operator. - The reservoir operator designated by the Reclamation Board of the State of California is responsible for:

a. Keeping informed of the rules and regulations contained in the Reservoir Regulation Manual and bringing to the attention of the District Engineer any feature of the manual that may require clarification.

b. Keeping the District Engineer advised of any inaccuracies contained in the manual or that may develop as a consequence of changed conditions.

c. Advising the District Engineer of any need for emergency change in operation.

d. Keeping familiar with the functioning and workings of all recording equipment.

e. Accomplishing the physical operation of the reservoir in accordance with the official regulations.

f. Calculating and maintaining a continuous provisional record of storage and flows specified in the official regulations.

g. Reporting to the District Engineer any unusual condition in the reservoir or along downstream channels that might interfere with the planned operation of the reservoir.

h. Maintaining a log of gate operation for each outlet containing (1) change in position of gates, (2) date and time when such changes were made, and (3) the initials of the individual accomplishing the change.

i. Immediately after the end of each month transmitting to the Reservoir Regulation Section of the Corps of Engineers, Sacramento, California, a summary of operational data for that month.

j. Making emergency operation changes in operation when communication with the District Engineer is broken and a clearly defined change in condition occurs that warrants immediate action.

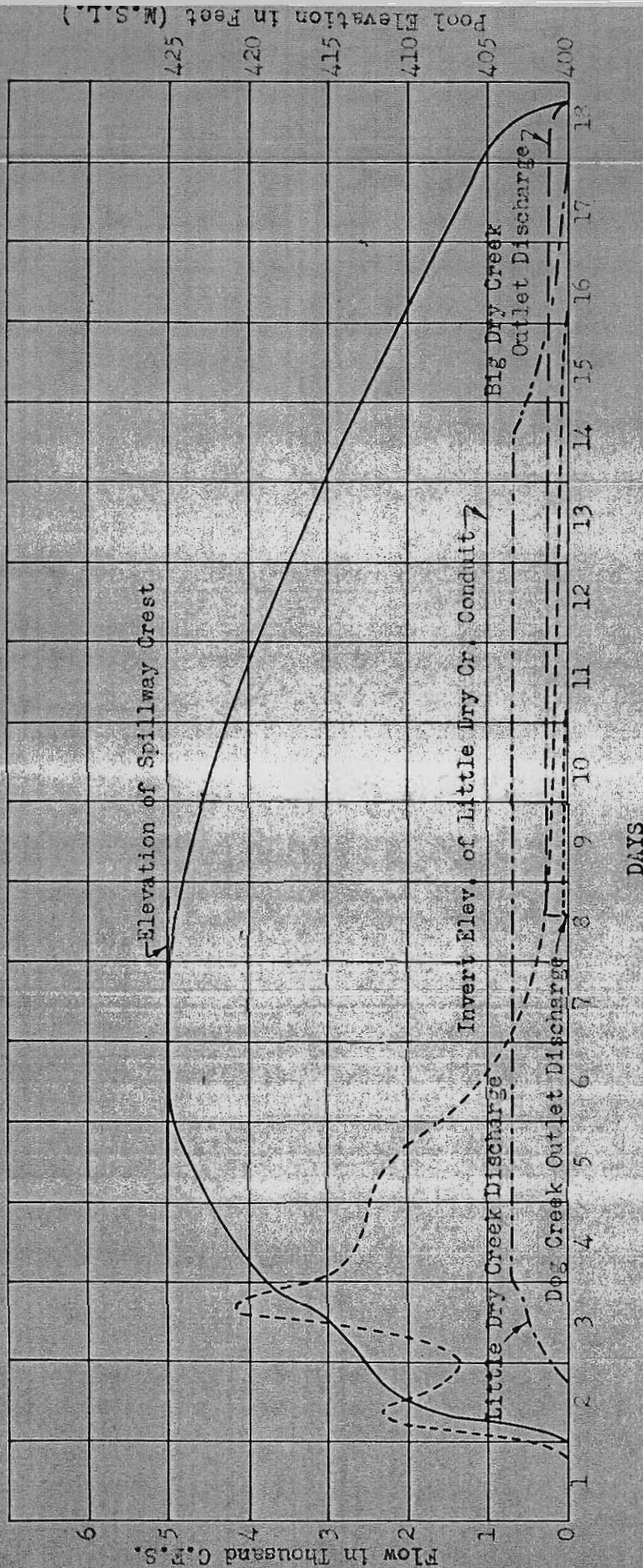
10. In connection with the operation of this project the District Engineer, Corps of Engineers, will perform the following functions:

a. Keep informed of storm and flood conditions affecting the operation of Big Dry Creek Reservoir.

b. Anticipate the need for an emergency change in reservoir operation due to conditions downstream on San Joaquin River, and notifying the operating agency of the emergency changes to be made.

c. Approve emergency change in operation recommended by the operating agency.

d. Prepare monthly operation and other special reports relative to operation of the reservoir as required by the Office, Chief of Engineers.



BIG DRY CREEK RESERVOIR
Fresno County Stream Group, Calif.

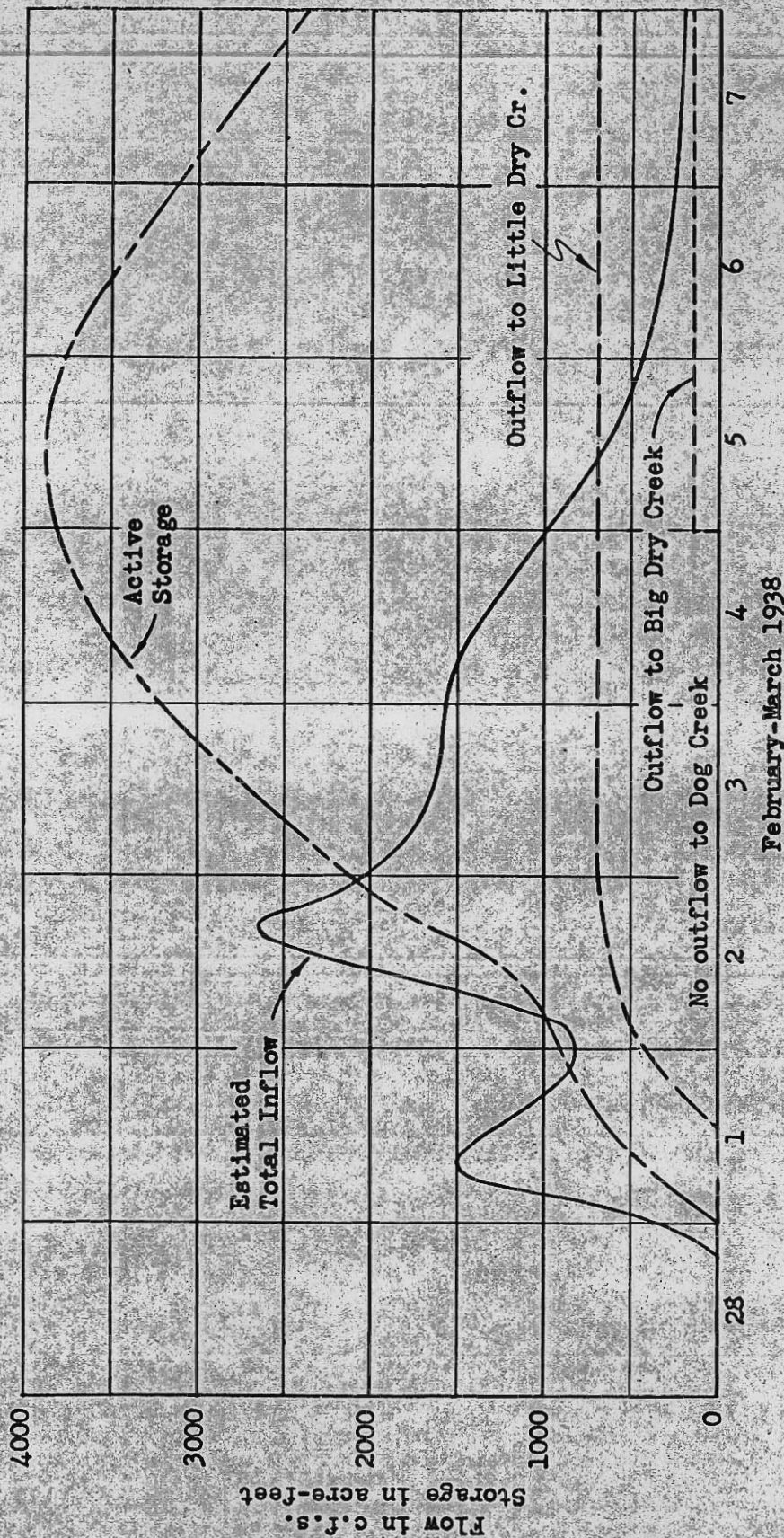
RESERVOIR DESIGN FLOOD
ROUTING

Corps of Engineers Sacramento, Calif.

Prepared by: A.J.C.

10 April 1959

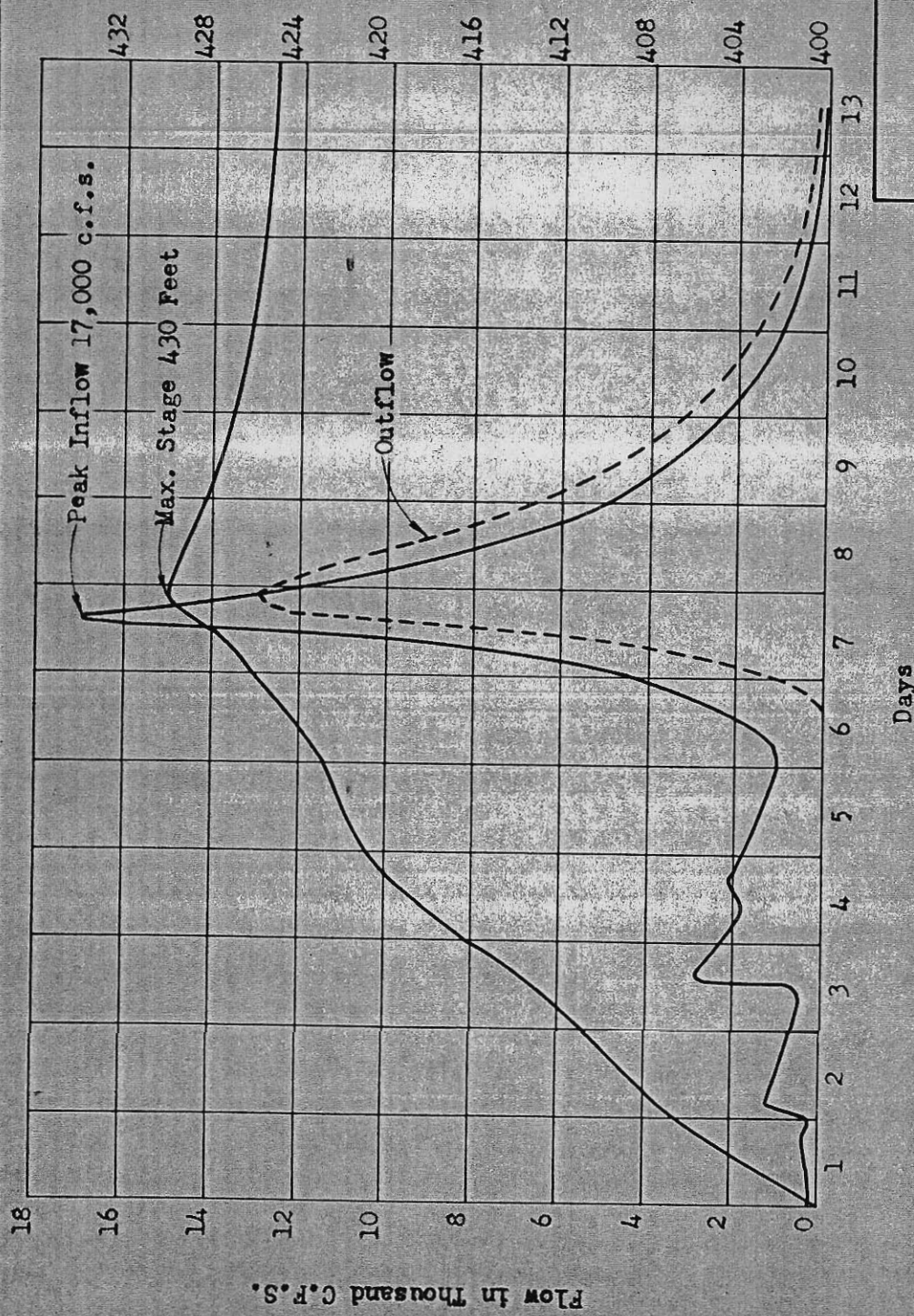
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BIG DRY CREEK RESERVOIR
Fresno County Stream Group, Calif.

HYPOTHETICAL OPERATION
FLOOD OF MARCH 1938

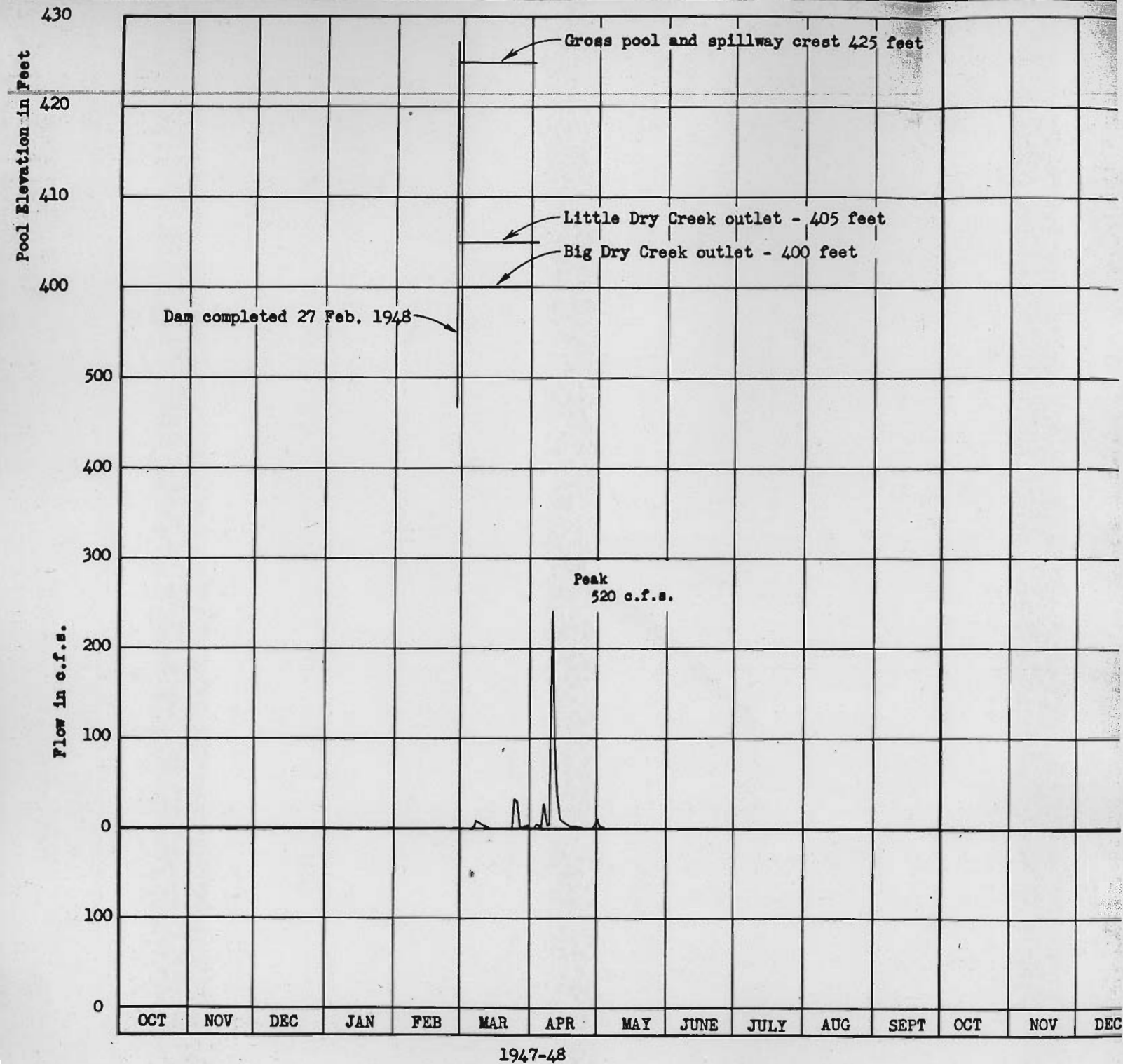
Corps of Engineers, Sacramento, Calif.
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BIG DRY CREEK RESERVOIR
 Fresno County Stream Group, California

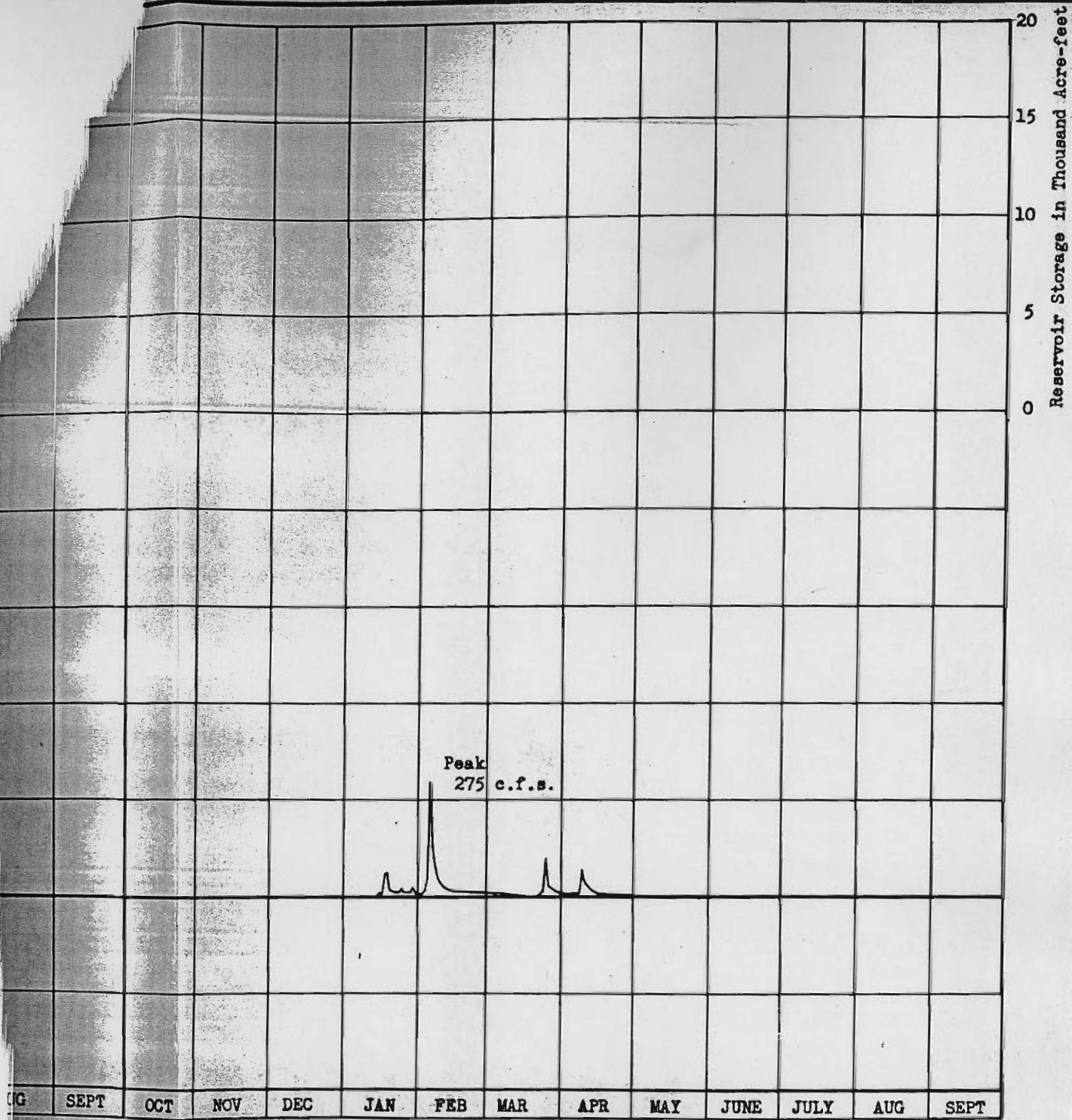
SPILLWAY DESIGN FLOOD
 ROUTING

Corps of Engineers Sacramento, Calif.
 Prepared by A.G.C. 10 April 1953



NOTE:

Hydrographs show mean da
peaks indicated are in



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BIG DRY CREEK PROJECT
Fresno County Stream Group, California

OPERATION RECORD
BIG DRY CREEK RESERVOIR

Sheet 1

Corps of Engineers

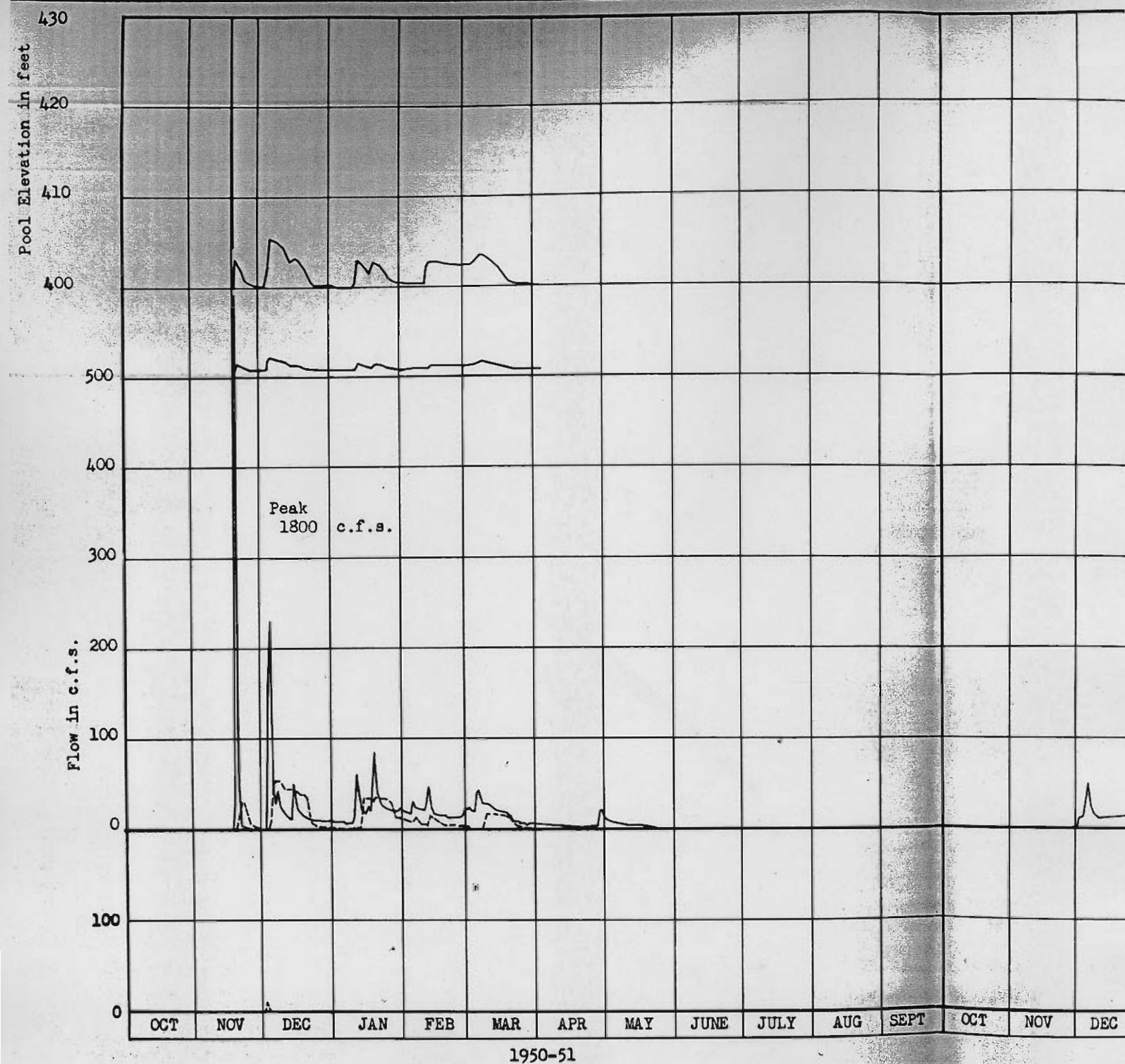
Sacramento, California

File No. SJ-1-26-145

Prepared by: V.G.K.

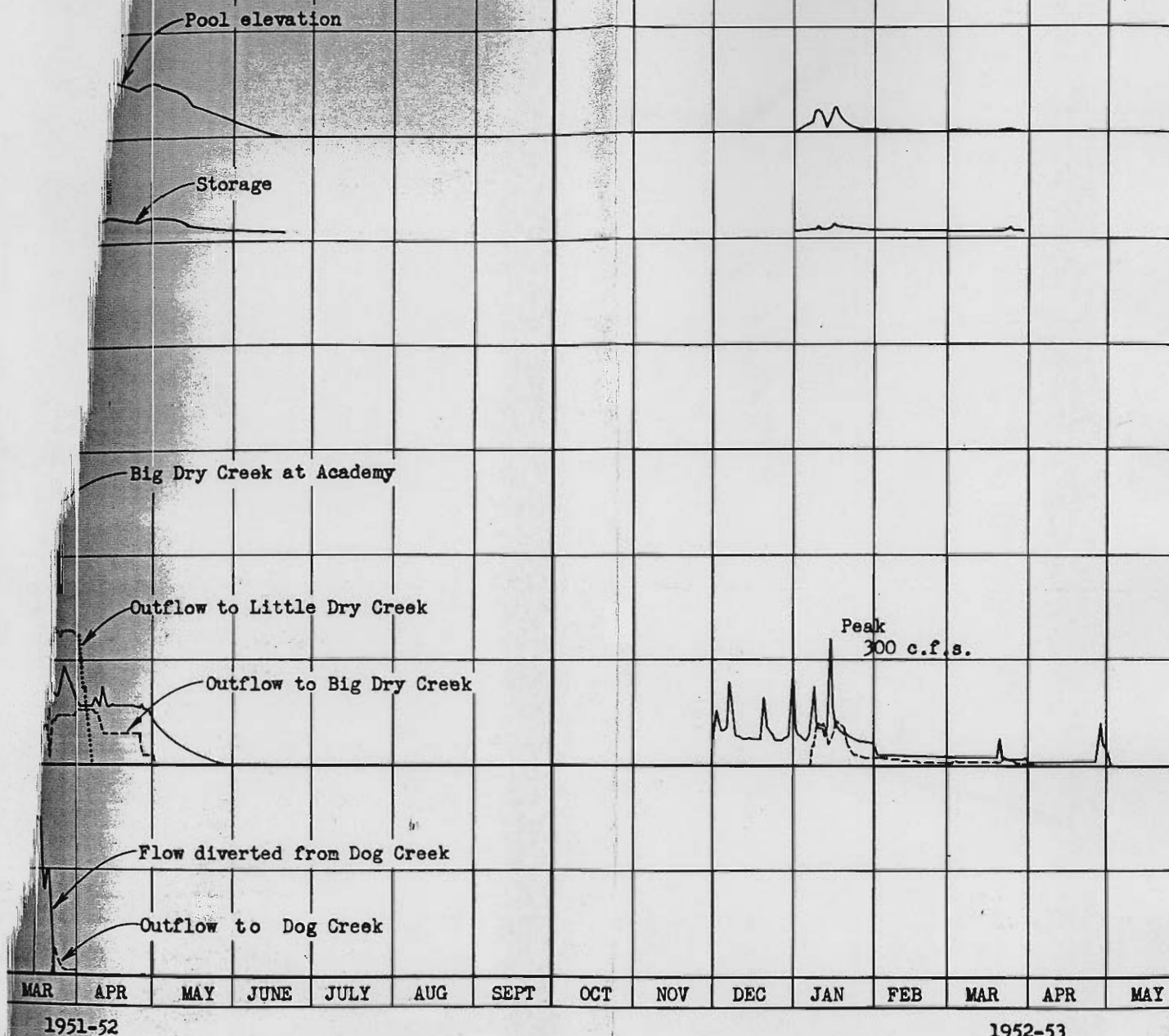
Date: 30 June 1950

CHART B-3



NOTE:

Hydrographs show mean daily flows;
peaks indicated are instantaneous flows.

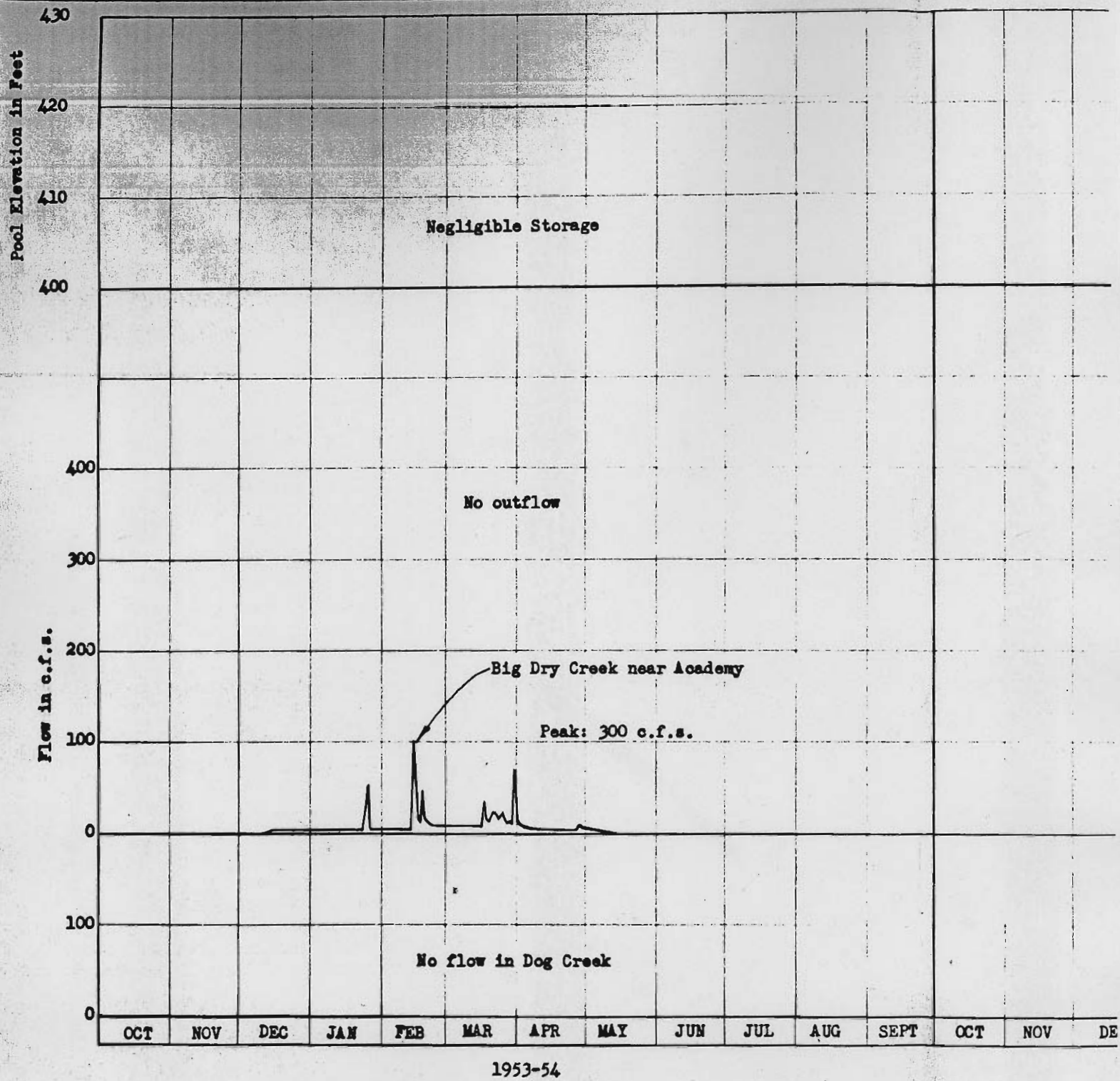


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Corps of Engineers
Prepared by: V.G.K

File No. SJ-1-26-145



Note:

Hydrographs show mean daily
peaks indicated are instantaneous

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File No. SJ-1-26-145

Corps of Engineers
Prepared by: V.G.K.

PART C

REGULATIONS

BIG DRY CREEK RESERVOIR AND DIVERSION
FRESNO COUNTY STREAM GROUP, CALIFORNIA

1 July 1954

TITLE 33--NAVIGATION AND NAVIGABLE WATERS

Chapter II--Corps of Engineers,
Department of the Army

PART 208--FLOOD CONTROL REGULATIONS

BIG DRY CREEK RESERVOIR AND DIVERSION, FRESNO COUNTY STREAM GROUP,
CALIFORNIA

Pursuant to the provision of section 3 of the act of Congress approved August 18, 1941 (55 Stat. 647) and section 7 of the act of Congress approved December 22, 1944 (58 Stat. 890; 33 U. S. C. 709), #208.83 is hereby prescribed to govern the use and operation of Big Dry Creek Reservoir and Diversion, on Big Dry Creek of the Fresno County Stream Group, California, for flood control purposes:

#208.83 Big Dry Creek Reservoir and Diversion. The Reclamation Board, State of California, shall operate Big Dry Creek Reservoir and Diversion for flood control as follows:

(a) Releases through the Dog Creek Outlet and the Big Dry Creek outlet shall be restricted to the maximum flow, as determined by the operating agency, which can be passed through these structures without causing serious damage along Dog Creek, Big Dry Creek, or any of the distributary or inter-connected channels associated therewith, except as prescribed in paragraphs (d) and (e) of this section. However, releases through these outlets shall be restricted by gate closure only when necessary to prevent the aforementioned flood damage.

(b) Releases through the Little Dry Creek Outlet shall be maintained at the maximum rate which can be passed through that structure without causing the total flow in the Little Dry Creek Outlet channel (release through outlet augmented at times by local inflow and/or minor flow over the main spillway) to exceed a quantity (estimated to be 700 c. f. s.), which would cause flow over the wasteway in the outlet channel dike or which would cause structural damage to the drop structures downstream except as prescribed in paragraph (e) of this section.

(c) All storage space in Big Dry Creek Reservoir shall be kept available for flood control except when storage of floodwater is necessary as a result of the release criteria prescribed in paragraphs (a) and (b) of this section. Any water temporarily stored in the reservoir shall be released as rapidly as can be accomplished without exceeding the release criteria prescribed in paragraphs (a) and (b) of this section.

(d) In the event that there is flow over the wasteway in the outlet channel dike as a result of reservoir levels above the spillway crest elevation at 425.0 feet m. s. l., releases through Dog Creek Outlet and Big Dry Creek Outlet may be temporarily increased above those prescribed in paragraph (a) of this section, when the operating agency finds that such increased releases would reduce the over-all damage in the region protected by this project.

(e) In the event that the reservoir level rises above the spillway design flood pool level of 430.0 feet m. s. l., all outlets shall be fully opened and kept open and unobstructed until the reservoir level recedes elevation 430.0 feet m. s. l.

(f) A continuous record shall be maintained of Big Dry Creek Reservoir stage, inflow from Big Dry Creek, inflow to the Dog Creek diversion structure, release through the Dog Creek Outlet, diversion from Dog Creek to Big Dry Creek, release through the Big Dry Creek Outlet, release through the Little Dry Creek Outlet, flow to Little Dry Creek through the Little Dry Creek Outlet channel, and such other operational data as shall be deemed necessary by the operating agency or as shall be requested by the District Engineer, Corps of Engineers, Department of the Army, in charge of the locality.

(g) The operating agency shall keep the District Engineer, Corps of Engineers, currently advised of operational data described in paragraph (f) of this section whenever water is stored above elevation 405 feet or when otherwise requested by the District Engineer, and shall report preliminary values of operational data monthly on or before the 5th day of the following month and final values thereof covering the period from October through September on or before the first day of December of each year to the District Engineer.

(h) The flood-control regulations of this section are subject to temporary modification by the District Engineer, Corps of Engineers, if found necessary in time of emergency. Requests for and action on such modifications may be made by any available means of communication, and the action taken by the District Engineer shall be confirmed in writing under date of the same day to the office of the Reclamation Board, State of California.

(Regs., June 11, 1954) (Sec. 7, 58 Stat. 890; 33 U. S. C. 709)

(SEAL)

JOHN A. KLEIN
Major General, U. S. Army
The Adjutant General

(F. R. Doc. 54-5150; Filed, July 7, 1954; 8:45 a.m.)

(Copied from Federal Register dated 8 July 1954)

D R A F T

TITLE 33--NAVIGATION AND NAVIGABLE WATERS

Chapter II -- Corps of Engineers
Department of the Army

PART 208 -- FLOOD CONTROL REGULATIONS

BIG DRY CREEK RESERVOIR AND DIVERSION
FRESNO COUNTY STREAM GROUP, CALIFORNIA

Pursuant to the provision of section 7 of the act of Congress approved December 22, 1944 (58 Stat. 890; 33 U. S. C. 709), #208. is hereby prescribed to govern the use and operation of Big Dry Creek Reservoir and Diversion, on Big Dry Creek of the Fresno County Stream Group, California, for flood-control purposes:

#208. Big Dry Creek Reservoir and Diversion. The Reclamation Board, State of California, shall operate Big Dry Creek Reservoir and Diversion for flood control as follows:

(a) Releases through the Dog Creek Outlet and the Big Dry Creek Outlet shall be restricted to the maximum flow, as determined by the operating agency, which can be passed through these structures without causing serious damage along Dog Creek, Big Dry Creek, or any of the distributary or interconnected channels associated therewith, except as prescribed in paragraphs (d) and (e) of this section. However, releases through these outlets shall be restricted by gate closure only when necessary to prevent the aforementioned flood damage.

(b) Releases through the Little Dry Creek Outlet shall be maintained at the maximum rate which can be passed through that structure

without causing the total flow in the Little Dry Creek Outlet Channel (release through outlet augmented at times by local inflow and/or minor flow over the main spillway) to exceed a quantity (estimated to be 700 c.f.s.), which would cause flow over the wasteway in the diversion channel dike or which would cause structural damage to the drop structures downstream except as prescribed in paragraph (e) of this section.

(c) All storage space in Big Dry Creek Reservoir shall be kept available for flood control except when storage of floodwater is necessary as a result of the release criteria prescribed in paragraphs (a) and (b) of this section. Any water temporarily stored in the reservoir shall be released as rapidly as can be accomplished without exceeding the release criteria prescribed in paragraphs (a) and (b) of this section.

(d) In the event that there is flow over the wasteway in the diversion channel dike as a result of reservoir levels above the spillway crest elevation of 425.0 feet m.s.l., releases through Dog Creek Outlet and Big Dry Creek Outlet may be temporarily increased above those prescribed in paragraph (a) of this section, when the operating agency finds that such increased releases would reduce the over-all damage in the region protected by this project.

(e) In the event that the reservoir level rises above the spillway design flood pool level of 430.0 feet m.s.l., all outlets shall be fully opened and kept open and unobstructed until the reservoir level recedes below elevation 430.0 feet m.s.l.

(f) A continuous record shall be maintained of Big Dry Creek Reservoir stage, inflow from Big Dry Creek, inflow to the Dog Creek diversion

structure, release through the Dog Creek Outlet, diversion from Dog Creek to Big Dry Creek, release through the Big Dry Creek Outlet, release through the Little Dry Creek Outlet, flow to Little Dry Creek through the Little Dry Creek Outlet channel, and such other operational data as shall be deemed necessary by the operating agency or as shall be requested by the District Engineer, Corps of Engineers, Department of the Army, in charge of the locality.

(g) The operating agency shall keep the District Engineer, Corps of Engineers, currently advised of operational data described in paragraph (f) of this section whenever water is stored above elevation 405 feet or when otherwise requested by the District Engineer, and shall report preliminary values of operational data monthly on or before the 5th day of the following month and final values thereof covering the period from October through September on or before the first day of December of each year to the District Engineer.

(h) The flood-control regulations of this section are subject to temporary modification by the District Engineer, Corps of Engineers, if found necessary in time of emergency. Requests for and action on such modifications may be made by any available means of communication, and the action taken by the District Engineer shall be confirmed in writing under date of the same day to the office of the Reclamation Board, State of California.



FRESNO METROPOLITAN FLOOD CONTROL DISTRICT

November 13, 1987

File No. 630.13

DISTRICT ENGINEER
U.S. ARMY CORPS OF ENGINEERS
650 Capitol Mall
Sacramento, CA 95814

Dear Sir:

RESPONSIBLE PERSONNEL LIST BIG DRY CREEK RESERVOIR

The Fresno Metropolitan Flood Control District has recently assumed responsibility for operation and maintenance of the Big Dry Creek Reservoir and Diversion in accordance with the appointment as the local sponsor agency for the upcoming Redbank-Fancher Creek Flood Control Project. As such, the District will be assuming the duties of "Superintendent" as noted in paragraph 12 of the Maintenance Manual for the Big Dry Creek Reservoir and Diversion.

Pursuant to the requirements of paragraph 15a(2) of the Maintenance Manual for Big Dry Creek Reservoir and Diversion, California, the following names and telephone numbers of personnel responsible for the operation of the Big Dry Creek Reservoir and Diversion Project are furnished below. They are listed in the order of call priority.

	<u>TELEPHONE NUMBER</u>	
	<u>OFFICE</u>	<u>HOME</u>
Alan Hofmann, Operations Engineer	(209) 485-6330	(209) 227-2040
Jerry Lakeman, District Engineer	(209) 485-6330	(209) 431-0935
Jerry Isler, Sr. Construction Tech	(209) 485-6330	(209) 292-7586
Doug Harrison, Gen. Manager-Secretary	(209) 485-6330	(209) 431-1513
Bill Stonehouse, Construction Tech I	(209) 485-6330	(209) 297-8773

486-3242

Very truly yours,

ALAN HOFMANN
OPERATIONS ENGINEER

PROJECT SUPERINTENDANT

LOCAL COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE FRESNO METROPOLITAN FLOOD CONTROL DISTRICT
FOR
FLOOD CONTROL DEVELOPMENT
FOR CONSTRUCTION OF
THE REDBANK AND FANCHER CREEKS, CALIFORNIA, PROJECT

THIS AGREEMENT, entered into this 1st day of August, 1987, by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government"), acting by and through the Acting Assistant Secretary of the Army (Civil Works), (hereinafter referred to as the "Secretary"), and the Fresno Metropolitan Flood Control District (hereinafter referred to as "the Local Sponsor").

WITNESSETH, THAT:

WHEREAS, the construction of the Redbank and Fancher Creeks, California project (hereinafter referred to as the "Project") was authorized by the Water Resources Development Act of 1986 (Public Law 99-662), in accordance with the recommendations of the Chief of Engineers in his Report dated 7 May 1981; and,

WHEREAS, the Water Resources Development Act of 1986, Public Law 99-662, specifies the cost-sharing requirements applicable to the Project; and,

WHEREAS, a General Design Memorandum dated February 1986 for the Project was approved by the Chief of Engineers on 11 June 1986, and is the substantial basis for all subsequent design and construction of the Project, subject to changes and modifications made in accordance with this Agreement; and,

WHEREAS, the Local Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in project cost-sharing and financing in accordance with the terms of this Agreement:

NOW, THEREFORE, the parties agree as follows:

ARTICLE I - DEFINITIONS

For purposes of this Agreement:

1. The term "Project" shall mean raising the existing Big Dry Creek Dam on Dry Creek including modifications of the Dry Creek Crossing of the Friant-Kern Canal, and construction of Fancher Creek Dam and Reservoir on Fancher Creek, Pup Creek Detention Basin on Pup Creek, Alluvial Drain Detention Basin on Alluvial Drain, and Redbank Creek Detention Basin on Redbank Creek.

2. The term "total project costs" shall mean all costs incurred by the Local Sponsor and the Government directly related to construction of the Project. Such costs shall include, but not necessarily be limited to, actual construction costs; costs of applicable engineering and design; Continuation of Planning and Engineering costs incurred after October 1, 1985; supervision and administration costs; costs of project construction contract dispute settlements or awards; and the value of lands, easements, rights-of-way, relocations, and material disposal areas provided for the Project by the Local Sponsor, but shall not include any costs for betterments or operation, maintenance, inspection, rehabilitation and replacement.

3. The term "period of construction" shall mean the time from the advertisement of the first construction contract to the time of acceptance of the Project by the Contracting Officer.

4. The term "Contracting Officer" shall mean the Commander of the U.S. Army Engineer District, Sacramento, or his designee.

5. The term "highway" shall mean any highway, thoroughfare, roadway, street, or other public or private road or way.

ARTICLE II - OBLIGATIONS OF THE PARTIES

a. The Government, subject to and using funds provided by the Local Sponsor and appropriated by the Congress, shall expeditiously construct the Project, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The Government shall use its best effort to secure continued funding and the scheduled completion of project construction.

b. The Government shall consider adjustments to the project construction schedule when so requested by the Local Sponsor to meet local project-financing requirements.

c. The Local Sponsor shall be afforded the opportunity to review and comment on all designs and contracts, including relevant plans and specifications, prior to the issuance of invitations for bids. The Local Sponsor also shall be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. The Government will consider the views of the Local Sponsor, but award of the contracts and performance of the work thereunder shall be exclusively within the control of the Government.

d. When the Government determines that the Project, or feature thereof, is complete, the Government shall turn the Project or feature over to the Local Sponsor, which shall accept the Project or feature and be solely responsible for operating, maintaining, inspecting, replacing, and rehabilitating the Project or feature in accordance with Article VIII hereof.

e. As further specified in Article VI hereof, the Local Sponsor shall provide, during the period of construction, a cash contribution of 5 percent of total project costs.

f. As further specified in Article III hereof, the Local Sponsor shall provide all lands, easements, rights-of-way, and material disposal areas, and perform all relocations and alterations of buildings, utilities, highways, railroads (except railroad bridges and approaches), bridges (except abutments and additional footings that are structural and integral to the project), sewers, and related and special facilities determined by the Government to be necessary for construction of the Project.

g. If the value of the contributions provided under paragraphs e. and f. of this Article represents less than 25 percent of total project costs, the Local Sponsor shall provide during the period of construction an additional cash contribution in the amount necessary to make its total contribution equal to 25 percent of total project costs.

h. No less than once each year the Local Sponsor shall inform affected interests of the limitations of the protection afforded by the Project.

i. The Local Sponsor shall publicize floodplain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the Project.

j. The Local Sponsor shall, to the extent of its powers, prescribe and enforce regulations to prevent any obstruction or encroachment that would impair the flood control effectiveness of the Project. In addition, the Local Sponsor shall preserve or restore and thereafter maintain channels and diversion-of-flow structures required for conveyance of floodwaters within the project area to at least those capacities specified for the flood control system operation plan defined in the Water Control Manual. The Government shall provide the Water Control Manual to the Local Sponsor during the period of construction.

k. The Local Sponsor shall adjust all claims regarding water rights that might be affected by the Project.

ARTICLE III - LANDS, FACILITIES, AND RELOCATIONS ASSISTANCE

a. Prior to the advertisement of any construction contract, the Local Sponsor shall furnish to the Government all lands, easements, and rights-of-way, including suitable borrow and material disposal areas, as may be determined by the Government to be necessary for such construction and related operation and

maintenance, and shall furnish to the Government evidence supporting the Local Sponsor's legal authority to grant rights-of-entry to such lands.

b. Upon notification from the Government, the Local Sponsor shall accomplish or arrange for accomplishment at no cost to the Government of all alterations and relocations of buildings, highways, railroads (except railroad bridges and approaches), bridges (except abutments and additional footings that are structural and integral to the Project), storm drains, utilities, cemeteries, and other facilities, structures and improvements determined by the Government to be necessary for construction of the Project.

c. The Local Sponsor shall provide or pay to the Government the full cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged material disposal areas necessary for construction of the project.

d. The Local Sponsor shall comply with the applicable provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, approved January 2, 1971, in acquiring lands, easements, and rights-of-way for construction and subsequent inspection, operation, maintenance and rehabilitation of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - VALUE OF LANDS AND FACILITIES

a. The value of the lands, easements, and rights-of-way to be included in total project costs and credited toward the Local Sponsor's share of total project costs will be determined in accordance with the following procedures:

1. For those lands, easements, or rights-of-way owned by the Local Sponsor as of the date this Agreement is signed, the credit shall be the actual purchase price and associated acquisition costs which are reasonable, allocable and allowable to be determined at the time such interest is made available to the Government for construction of the Project. The purchase price credit shall be determined by a previously obtained appraisal which has been prepared by an independent and qualified appraiser who is acceptable to both the Local Sponsor and the Government. The appraisal shall be reviewed and is subject to approval by the Government. The Local Sponsor has requested purchase price credit in lieu of the fair market value.

2. If the lands, easements, or rights-of-way are to be acquired by the Local Sponsor after the date this Agreement is signed, the credit shall be the fair market value of the interest at the time such interest is made available to the Government for construction of the Project. The fair market value shall be determined as specified in subparagraph 1. of this Article. If

the Local Sponsor pays an amount in excess of the appraised fair market value, it may be entitled to a credit for the excess if the Local Sponsor has secured prior written approval from the Government of its offer to purchase such interest.

3. If the Local Sponsor acquires more lands, easements (or easement interests), or rights-of-way than are necessary for project purposes, as determined by the Government, then only the value of such portions of those acquisitions as are necessary for project purposes shall be included in the total project costs and credited to the Local Sponsor's share.

4. Credit for lands, easements, and rights-of-way in the case of involuntary acquisitions which have occurred or are in process within a one-year period preceding the date this Agreement is signed or which occur after the date this Agreement is signed will be the value given by court awards, or by stipulated settlements (that have received prior Government approval) determined prior to the final accounting of the Project.

5. For lands, easements, or rights-of-way acquired by the Local Sponsor within a five-year period preceding the date this Agreement is signed, or any time after this Agreement is signed, credits provided under this paragraph will also include the actual, reasonable, incidental costs of acquiring the interest, e.g., closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for any relocation assistance provided in accordance with the obligations under this Agreement.

b. The costs of relocations or modifications of utilities or facilities that will be included in total project costs and credited towards the Local Sponsor's share of total project costs shall be that portion of the actual costs incurred by the Local Sponsor as set forth below:

1. Highways and Highway Bridges: Only that portion of the cost as would be necessary to construct substitute bridges and highways to the design standard that the State of California would use in constructing a new bridge or highway under similar conditions of geography and traffic loads. Abutments and additional footings which are structural and integral to the Project, however, are to be considered part of the Project construction and will be cost shared in the same proportion as the total project costs.

2. Utilities and Facilities (including Railroads, except Railroad Bridges and Approaches): Actual relocation costs, less depreciation, less salvage value, plus the cost of removal, less the cost of betterments. With respect to betterments, new materials shall not be used in any relocation or alteration if materials of value and usability equal to those in the existing facility are available or can be obtained as salvage from the existing facility or otherwise, unless the provision of new material is more economical. If, despite the availability of used

material, new material is used, where the use of such new material represents an additional cost, such cost will not be included in total project costs.

ARTICLE V - CONSTRUCTION PHASING AND MANAGEMENT

a. To provide for consistent and effective communication between the Local Sponsor and the Government during the period of construction, the Local Sponsor and the Government shall appoint representatives to coordinate on scheduling, plans, specifications, modifications, contract costs, and other matters relating to construction of the Project.

b. The representatives appointed above shall meet as necessary during the period of project construction and shall make such recommendations as they deem warranted to the Contracting Officer.

c. The Contracting Officer shall consider the recommendations of the representatives in all matters relating to the Project, but the Contracting Officer, having ultimate responsibility for construction of the Project, has complete discretion to accept, reject, or modify the recommendations.

ARTICLE VI - METHOD OF PAYMENT

a. The Local Sponsor shall provide, over the period of construction, the cash amounts required under Article II.e. and II.g. of this Agreement. Total project costs are presently estimated to be \$65,600,000. In order to meet its share, the Local Sponsor must provide a cash contribution presently estimated to be \$4,580,000.

b. The Local Sponsor shall provide its required cash contribution in proportion to the rate of Federal expenditures over the period of construction in accordance with the following provisions:

1. For purposes of budget planning, the Government shall notify the Local Sponsor by May of each year of the estimated funds that will be required from the Local Sponsor to meet its share of project costs for the corresponding Government fiscal year.

2. Sixty (60) calendar days prior to the award of the first construction contract, the Government shall notify the Local Sponsor of its share of project costs, including costs attributable to the project incurred prior to the initiation of construction, for the first fiscal year of construction. Within 30 calendar days after such notice, the Local Sponsor shall verify to the satisfaction of the Government that it has deposited the requisite amount in an escrow account acceptable to the Government, with interest accruing to the Local Sponsor.

3. For the second and subsequent fiscal years of project construction, the Government shall, 60 calendar days prior to the beginning of the fiscal year, notify the Local Sponsor of its share of project costs for that fiscal year. No later than 30 calendar days prior to the beginning of the fiscal year, the Local Sponsor shall deposit the necessary funds required by the Government in the escrow account specified in item b.2. above. As construction of the project proceeds, the Government may adjust the amounts required to be provided under this paragraph to reflect actual project costs.

4. If at any time during the period of construction the Government determines that additional funds will be needed from the Local Sponsor to meet its required share of project costs, the Government shall so notify the Local Sponsor and the Local Sponsor, within 30 calendar days from receipt of notice, shall make the necessary funds available through the escrow account specified in b.2. above but not later than 120 days after the beginning of the next fiscal year.

c. The Government will draw on the funds provided by the Local Sponsor such sums as it deems necessary to cover contractual and in-house fiscal obligations attributable to the Project as they are incurred, as well as project costs incurred by the Government prior to the initiation of construction. The trustee will provide the requested Government disbursements to the Finance and Accounting Officer, U.S. Army Corps of Engineers, Sacramento District, at the address specified in Article XVII. With each notice, the Government shall provide the Local Sponsor with an accounting of the projected utilization of specified funds. The Government shall notify the Local Sponsor in writing on a quarterly basis of the funding to be furnished to the Government.

d. Upon completion of the Project and resolution of all relevant contract claims and appeals, the Government shall compute the total project costs and tender to the Local Sponsor a final accounting of its share of project costs. In the event the total contribution by the Local Sponsor is less than its minimum required share of project costs at the time of the final accounting, the Local Sponsor shall, within 90 calendar days after receipt of written notice, but not later than 120 days after the beginning of the next Government fiscal year make a cash payment to the Government of whatever sum is required to meet its minimum required share of project costs. In the event the Local Sponsor has made cash contributions in excess of 5 percent of total project costs which result in the Local Sponsor's having provided more than its required share of project costs, the Government shall within 90 calendar days of the final accounting, subject to the availability of appropriations, return said excess to the Local Sponsor; however, the Local Sponsor shall not be entitled to any refund of the 5 percent cash contribution required pursuant to Article 11.e. hereof. If the Local Sponsor's total contribution under this Agreement (including lands, easements, rights-of-way, relocations, and material disposal areas provided by the Local Sponsor) exceeds 50 percent of total project costs, the Government

shall, subject to the availability of appropriations, refund the excess to the Local Sponsor within 90 calendar days of the final accounting.

e. At the sole discretion of the Government, the Local Sponsor may be permitted to perform engineering and design services and construct a 600-foot portion of the Pup Creek Detention Basin channel pipe near Temperance Avenue and the Alluvial Drain Detention Basin outlet works conduit, subject to Government audit. Any work performed by the Local Sponsor, and credited thereof, shall be in accordance with Section 215 of the Flood Control Act of 1968 (42 U.S.C. 1962d-5a).

ARTICLE VII - DISPUTES

Before any party to this Agreement may bring suit in any court concerning an issue relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or other forms of nonbinding alternative dispute resolution mutually acceptable to the parties.

ARTICLE VIII - OPERATION, MAINTENANCE, INSPECTION, AND REHABILITATION

a. After it is turned over by the Government, the Local Sponsor shall operate, maintain, inspect, replace, and rehabilitate the Project, or feature thereof, in accordance with regulations and directions, including the Water Control Manual, prescribed by the Government.

b. The Local Sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon land which it owns or controls for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, repairing, maintaining, replacing or rehabilitating the Project. If an inspection shows that the Local Sponsor for any reason is failing to fulfill its obligations under this Agreement without receiving prior written approval from the Government, the Government will send a written notice to the Local Sponsor. If the Local Sponsor persists in such failure for 30 calendar days after receipt of the notice, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon lands the Local Sponsor owns or controls for access to the Project for the purpose of completing, operating, repairing, maintaining, replacing, or rehabilitating the Project. No inspection, completion, operation, repair, maintenance, replacement, or rehabilitation by the Government shall operate to relieve the Local Sponsor of responsibility to meet its obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to this Agreement.

ARTICLE IX - RELEASE OF CLAIMS

The Local Sponsor shall hold and save the Government free from all damages arising from the construction, operation, and maintenance of the Project, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE X - MAINTENANCE OF RECORDS

The Government and the Local Sponsor shall keep books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total project costs. The Government and the Local Sponsor shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the Project and resolution of all claims arising therefrom, and shall make available at their offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the parties to this Agreement.

ARTICLE XI - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the Local Sponsor agrees to comply with all applicable Federal and state laws and regulations, including section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

ARTICLE XII - RELATIONSHIP OF PARTIES

The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

ARTICLE XIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XIV - COVENANT AGAINST CONTINGENT FEES

The Local Sponsor warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the local sponsor for the purpose of securing business. For breach or violation of this warranty, the Government shall have

the right to annul this Agreement without liability, or, in its discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XV - TERMINATION OR SUSPENSION

a. If at any time the Local Sponsor fails to make the payments required under this Agreement, the Secretary of the Army shall terminate or suspend work on the Project until the Local Sponsor is no longer in arrears, unless the Secretary determines that continuation of work on the Project is in the interest of the Government. Any delinquent payment shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

b. If the Government fails to receive annual appropriations in amounts sufficient to meet project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Local Sponsor. After 60 calendar days either party may elect without penalty to terminate this Agreement or to suspend performance thereunder, and the parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article VI.

ARTICLE XVI - OBLIGATION OF FUTURE APPROPRIATIONS

Nothing herein shall constitute, or be deemed to constitute, an obligation of future appropriations of the legislature of the State of California.

ARTICLE XVII - NOTICES

a. All notices, requests, demands, and other communications required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and delivered personally, given by prepaid telegram, or mailed by first-class (postage-prepaid), registered, or certified mail, as follows:

If to the Local Sponsor:

Fresno Metropolitan Flood Control District
Suite 300, Rowell Building
Fresno, California 93721

If to the Government:

U.S. Army Corps of Engineers
Sacramento District
650 Capitol Mall
Sacramento, California 95814-4794

b. A party may change the address to which such communications are to be directed by giving written notice to the other in the manner provided in this Article.

c. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at such time as it is personally delivered or on the third business day after it is mailed, as the case may be.

ARTICLE XVIII - CONFIDENTIALITY

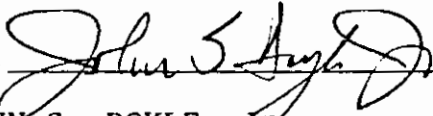
To the extent permitted by the law governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XIX - PRIOR AGREEMENT

This agreement shall supersede that Agreement of Assurance to the Secretary of War, dated 11 March 1947, by the Reclamation Board of the State of California, for operation and maintenance of the Big Dry Creek Dam and appurtenant facilities, upon execution of this agreement. During the period between execution of this agreement and such time as the enlarged Big Dry Creek Dam has been completed and turned over to the Local Sponsor for operation, maintenance, inspection, replacement, and rehabilitation in accordance with Articles II and VIII hereof, the Local Sponsor shall assume all responsibilities and liabilities for the existing Big Dry Creek Dam previously held by the Reclamation Board of the State of California, as set out in the aforementioned Agreement of Assurance.

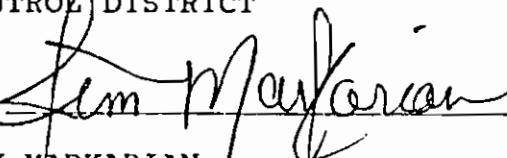
IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the day and year first above written.

THE DEPARTMENT OF THE ARMY

BY: 
JOHN S. DOYLE, JR.
Acting Assistant Secretary
of the Army (Civil Works)

DATE: August 1, 1987

FRESNO METROPOLITAN FLOOD
CONTROL DISTRICT

BY: 
JIM MARKARIAN
Chairman, Board of Directors

DATE: August 1, 1987

ATTEST: 
DOUG HARRISON
District Secretary

DATE: August 1, 1987

CERTIFICATE OF AUTHORITY

I, Douglas B. Jensen, do hereby certify that I am the Counsel for the Fresno Metropolitan Flood Control District, that the Fresno Metropolitan Flood Control District is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the Fresno Metropolitan Flood Control District in connection with the Redbank and Fancher Creeks, California, Flood Control Project, and pay damages, if necessary, in the event of the failure to perform in accordance with Section 221 of Public Law 91-611 and that the persons who have executed the Agreement on behalf of the Fresno Metropolitan Flood Control District, have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed the Certificate this 1st day of August, A.D., 1987.



Counsel, Fresno Metropolitan
Flood Control District

PRIOR AGREEMENT CERTIFICATION

The State of California hereby acknowledges Article XIX of this Local Cooperation Agreement for the Redbank and Fancher Creeks, California project and hereby agrees that this Local Cooperation Agreement supersedes that agreement dated 11 March 1947 between the Reclamation Board of the State of California and the Government for the operation and maintenance of Big Dry Creek Dam.

THE RECLAMATION BOARD
OF THE STATE OF CALIFORNIA

BY: Wallace McCormick

President, The Reclamation Board

DATE: Aug 1 1987

BY: Walter J. Carter

Secretary, The Reclamation Board

DATE: August 1, 1987

HONORARY CHAIRMEN
CONTRACT SIGNING CEREMONY
REDBANK & FANCHER CREEKS
FLOOD CONTROL PROJECT

August 1, 1987

Bernie F. Sisk

THE HONORABLE B.F. "BERNIE" SISK
Representative in Congress, Retired

THE HONORABLE HAROLD T. "BIZ" JOHNSON
Representative in Congress, Retired

Ted C. Wills

THE HONORABLE TED C. WILLS
Mayor, City of Fresno, Retired

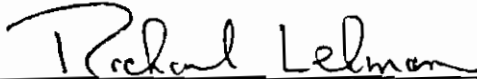
George F. Ilg


THE HONORABLE GEORGE F. ILG
Chairman, Fresno Metropolitan Flood Control District
Board of Directors, Retired


WITNESSES:

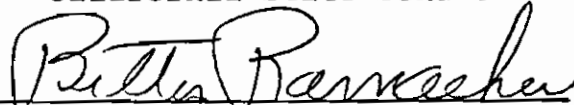
CONTRACT SIGNING CEREMONY
REDBANK & FANCHER CREEKS
FLOOD CONTROL PROJECT

August 1, 1987

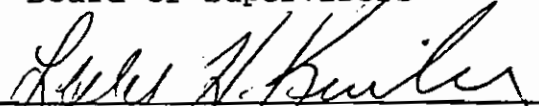

THE HONORABLE RICHARD LEHMAN
Representative in Congress

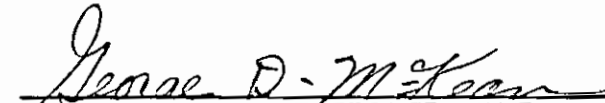

THE HONORABLE ROSE ANN VUCH
California State Senate



THE HONORABLE JIM COSTA
CALIFORNIA STATE ASSEMBLY



THE HONORABLE BETTY RAMACHER
Chairperson, Fresno County
Board of Supervisors

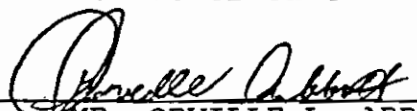

THE HONORABLE GARRY WOODWARD
Mayor, City of Clovis



THE HONORABLE LES KIMBER
Mayor Pro Tem, City of Fresno

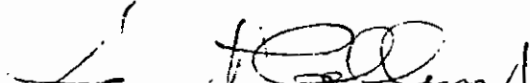

THE HONORABLE GEORGE MCKEAN
Chairman, Board of Directors
Kings River Conservation District



THE HONORABLE STEPHEN HALL
Vice President, The Reclamation Board
State of California


THE HONORABLE JACOB ANDRESEN
President, Board of Directors,
Fresno Irrigation District


MR. ORVILLE L. ABBOTT
Executive Officer & Chief Engineer
California Water Commission


MR. LOUIS A. BECK
Chief, San Joaquin District,
Department of Water Resources


COLONEL SAM P. COLLIN, JR.
Deputy Division Engineer
South Pacific Division
U.S. Army Corps of Engineers


FOR: COLONEL WAYNE J. SCHOLL
Commander, Sacramento District,
U.S. Army Corps of Engineers

The execution of this page by the above witnesses does not represent an endorsement by said witnesses of the specific provisions contained within the LCA involving the United States Government, Army Corps of Engineers and the Fresno Metropolitan Flood Control District.

Chapter XIV - Operation, Maintenance, and Inspection of
Completed Work

98. Introduction. - The flood control facilities for the Redbank and Fancher Creeks project, described in Chapter IV - Description of the Selected Plan, will be operated and maintained by Fresno Metropolitan Flood Control District (FMFCD) in accordance with the general guidelines presented in the following paragraphs, and as described in detail in an operation and maintenance manual which will be developed before completion of the project.

99. Operation. - The Corps of Engineers will furnish instructions to FMFCD who will be responsible for flood control operations of the project. Normal flood control operations include daily monitoring of flows and reservoir stages, described in Chapter XIII - System Operation, to facilitate the appropriate manipulation of control gates. Permanent operating equipment is described in Chapter IV - Description of the Selected Plan. Fancher Creek Dam and Pup Creek and Alluvial Drain detention basins will be ungated and consequently will require no operation during floods.

a. Big Dry Creek Reservoir. -

(1) Gate Operation. - Mechanical features of the Big Dry and Little Dry Creek outlet works are shown on Plates B3 and B5, respectively. The flow of water through both outlet works will be controlled by electrically operated wedge lock type slide gates, located in the rectangular gate passages in the control towers. The electrically operated gate controller and appurtenances will be located in a chamber at the top of the control towers. Any gate leaf may be held in any desired position to permit the regulation of discharges. Control of each gate will be accomplished with a manually operated stop/start system. Each gate hoist will be provided with a mechanical type visual gate positioner indicator graduated in tenths and hundredths of feet. Further, the gate controls will be fitted with a remote operating system to allow for gate operation from FMFCD's operation center. The maximum hoist speed in raising and lowering the gate will be approximately 0.5 feet per minute. However, during flood control operations, the rate of change in releases to the Little Dry Creek Diversion Channel will not be more than 200 cfs per hour. Manual means also will be provided for controlling the movement of the gates. This feature will allow operation during power outages and fine adjustment of gate positions. The towers will provide the necessary penetrations for future installation of a telemetering system to report the gate position by radio to a remote operating site.

Two 3.0-foot square gates will be provided in tandem at Big Dry Creek outlet works. The upstream gate will act as an emergency gate and the downstream gate as a service gate. At Little Dry Creek outlet works, two sets of tandem gates will be provided. All four gates will be 3.0 wide and 6.5 feet high. Two will act as emergency gates and two as service gates. The emergency gate in each passage of the intake structure can be used to control outflow if a service gate is inoperable. Also, an emergency gate can be closed to allow emergency work on an inoperable service gate. The bifurcated intake structure was incorporated into the design of Little Dry Creek control tower to provide additional safety. In the event that one intake port is blocked, the other port can pass 80 percent of the design flow.

Operation, Maintenance, and Inspection of Completed Work

The Big Dry Creek outlet works gate will be closed during reservoir flood control operations.

(2) Power requirements. - The electric power extensions and transformer banks for the project will be supplied by the servicing utility company. Power requirements are estimated as follows:

Big Dry Creek Outlet Works

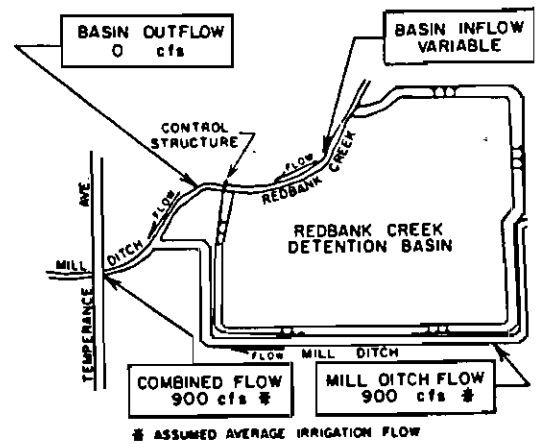
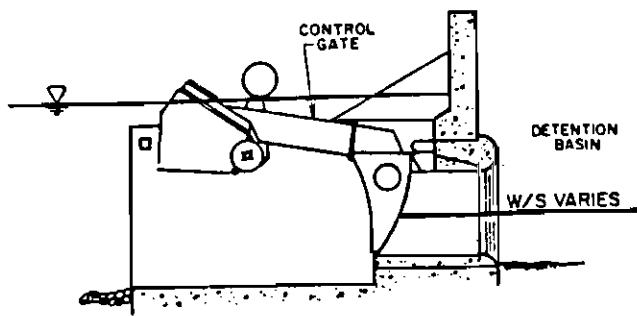
	<u>Local Demand</u> (Kilo Volt-Amp)
Sump pump motors, 1 hp 460V (future)	1.5
Lighting and miscellaneous power	5.0
Electrical Valve Actuators, 2 HP	<u>5.0</u>
Total estimated power demand at Control Shaft	11.5

Little Dry Creek Outlet Works

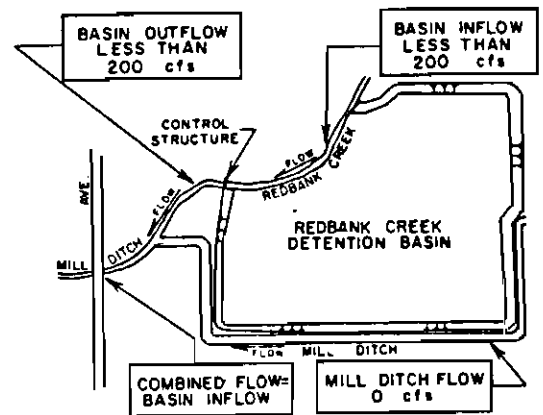
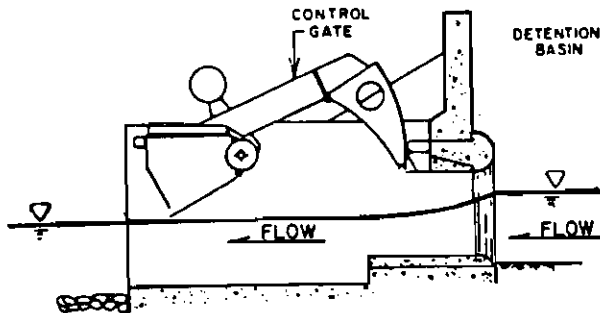
	<u>Local Demand</u> (Kilo Volt-Amp)
Sump pump motors, 1 hp 460V (future)	1.5
Lighting and miscellaneous power	5.0
Electrical Valve Actuators, 2 HP	<u>10.0</u>
Total estimated power demand at Control Shaft	16.5

b. Redbank Creek Detention Basin. - The mechanical features of the Redbank Creek Detention Basin outlet works are shown on Plate R2. The basin is designed so that water will be released through two orifices in the control structure. Flood control releases will be regulated by two automatic gates set in the control structure on the downstream side of the orifices. Gate operation is completely automatic and requires no electric power or manual manipulation. Each gate consists of a lever arm with a float chamber on the downstream end and a face plate on the upstream end and is designed so that the gate rotates in response to a change in tailwater elevation; as the tailwater rises, the gate face plate will descend behind the orifice, reducing the basin outflow. This reduction in orifice size causes a decrease in outflow which, in turn, drops the downstream water surface elevation, raising the gate. During this type of automatic operation, the downstream water surface will vary no more than ± 0.1 feet, assuring a relatively constant release for a fluctuating upstream head. The gates will be set during their installation to maintain a downstream water surface elevation of 338.5 corresponding to a constant release of 200 cfs, the normal maximum allowable flow in Mill Ditch at the Temperance Avenue control point.

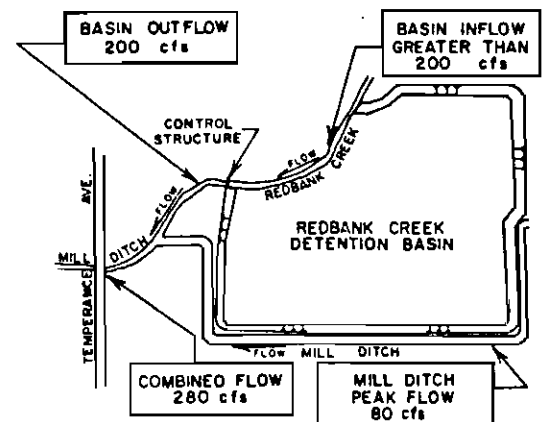
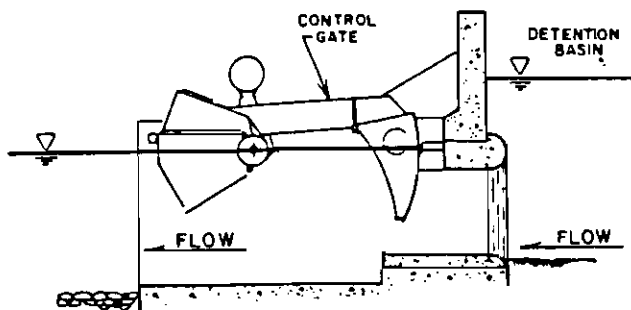
The gates are expected to have three distinctive modes of operation as shown schematically in Figure 8. Figure 8a shows the basin and gate configuration during irrigation season when Mill Ditch is flowing full. Backwater at the control structure from average irrigation flows in Mill Ditch of 900 cfs will be above elevation 338.6, the minimum elevation which



A. IRRIGATION SEASON (APR.-OCT.)



B. LOW FLOW



C. DESIGN FLOOD PEAK FLOW

Operation, Maintenance, and Inspection of Completed Work

causes the gates to close completely. When the gates are closed, all inflow to the basin is stored. This mode of operation is expected to occur from April through October. Figure 8b shows the basin and gate configuration expected between irrigation and flood season, when Mill Ditch flows and basin inflows are low and the water surface elevation just downstream of the control structure is below elevation 338.4. Under this condition the gates will be fully open, allowing free flow between the basin and Mill Ditch. Figure 8c shows the basin and gate configuration during the peak of the 200 year design flood. Basin inflow will be greater than 200 cfs and basin outflow will be regulated to 200 cfs. The only flow in Mill Ditch will be transient unregulated local runoff, estimated to peak at 80 cfs. The combined 200 cfs regulated release and peak 80 cfs local flow result in a short term peak flow of no more than 280 cfs in Mill Ditch at the Temperance Avenue control point, as indicated in Figure 6. If combined Mill Ditch flows and detention basin releases exceed 300 cfs, the resulting back water at the gates will reduce or completely shut off basin outflow.

100. Maintenance and Replacement. - Normal maintenance and required replacement associated with the dams, spillways, outlets works, channels, access roads, and hydrologic and communication facilities will be performed by the FMFCD in compliance with the Operation and Maintenance Manual to be prepared before completion of construction.

a. Maintenance of Embankments and Cut Slopes. - The provisions for embankment maintenance are spelled out in Paragraph (b) Levees, Section 208.10, Title 33 of the Code of Federal Regulations and any special instructions provided for this project. Measures are to be taken to promote the growth of sod on the earth embankments and cut slopes. All such embankment and cut slopes are to be kept mowed. The soil cement embankment sections for the detention basins are to be kept free of vegetation and other debris. These areas are to be inspected annually. Additionally, efforts will be required to prevent damage to embankments by burrowing rodents. The access and service roads are to be kept in usable condition at all times.

b. Maintenance of Exit Channels. - The FMFCD will be required to perform maintenance, operation, and inspection of all project exit channels in accordance with Section 208.10, Title 33 of the Code of Federal Regulations and any special instruction provided for this project. These regulations require regularly scheduled maintenance and inspection programs. All project channels, including rerouted Mill Ditch, must be maintained to their design grade, invert elevation, and capacity. Sediment is to be removed from the exit channels as required to maintain the design capacities. Local interests will be required to keep records of exit channel stream flows so that the effects of vegetation and other debris on channel capacity can be identified. Information regarding the functional capability of the project is to be reported annually.

Local interests will be responsible for maintaining riprap cobbles, and gabions placed as part of the project, and for providing any additional erosion control needed over the life of the project. Where riprap cobbles or gabions are placed as part of the project construction, it is to be kept free of vegetation and shall be inspected annually.

Operation, Maintenance, and Inspection of Completed Work

c. Detention Basins. - Sediment is to be removed from all detention basins periodically to maintain the design storage capacity and invert slopes.

d. Big Dry and Little Dry Creek Outlet Works. - At both Big Dry and Little Dry Creek outlet works, maintenance of either the emergency or service gates can be accomplished when the reservoir pool drops below elevation 400.0.

Access to the Little Dry Creek outlet works conduit for inspection purposes will be through the downstream portals. Access also could be from the upstream end when the reservoir pool is below elevation 403.0. Because of the small size of the Big Dry Creek outlet works conduit, a man hole will be provided between the service and emergency gates to allow direct access to the gate section. Access to the conduit can be had through the upstream portal when the reservoir pool is below elevation 400.0.

e. Redbank Creek Detention Basin. - Access to the gates for maintenance purposes will be afforded after the irrigation season when the flows in Mill Ditch are low and when the basin is dry. During all other times a visual inspection of the gates can be performed to determine their condition.

101. Miscellaneous Facilities. - Operation and maintenance of existing facilities in the Fresno-Clovis area used for flood control but not part of the proposed project will be required to meet the project purpose. These facilities must be maintained to the capacities indicated on Plate G7 for proper system operation, described in Chapter XII - System Operation and Appendix A. They include but are not limited to the Little Dry Creek diversion channel and wasteway and the Kings River diversion.

FMFCD also will be required to control encroachments in and along the project related streams and canals, keep records of flows and stages, and report on their functional capability annually. The design capacities shall be maintained by FMFCD to insure the proper functioning of the flood control project. The canals include the Enterprise, Gould, Fresno, Herndon Canal and Mill Ditch. The streams include all those directly affected by the proposed project such as Dog Creek, Dry Creek, Redbank Creek, Fancher Creek, Pup Creek, and Alluvial Drain as well as local streams indirectly affected such as Holland and Mud Creeks.

102. Periodic Inspection. - In accordance with Sec. 7, 58 Stat. 890, 33 USC 709, periodic inspections and reports shall be provided for each facility comprising the Redbank and Fancher Creeks, California project. The purpose of such inspections is to assure continuing structural adequacy of each dam, basin and associated structure. In addition, because the existing irrigation canals are a primary means of diverting surface flows during floods, annual project inspection will include the canals.

CHAPTER XII - OPERATION, MAINTENANCE AND INSPECTION OF COMPLETED WORK

56. General. - The Local Sponsor, Fresno Metropolitan Flood Control District (FMFCD) will operate and maintain Pup Creek, Alluvial Drain, and Redbank Creek detention basins in accordance with the Local Cooperation Agreement (LCA) and the Water Control and Maintenance manuals. The GDM presents information on the proposed project operation that is the basis for the project design and will be the basis of the Water Control and Maintenance manuals. These two manuals will be developed during construction of these features; as each detention basin is completed, an interim set of manuals will be developed for each feature and turned over to the Local Sponsor with that particular feature, for operation and maintenance.

57. Operations. - The Corps of Engineers will furnish instructions to FMFCD, who is solely responsible for flood control operations of the Redbank and Fancher Creeks project.

a. Basin Operations. - Pup Creek and Alluvial Drain detention basins are ungated and thus operation is not required. Outflow from Redbank Creek Detention Basin is controlled by automatic bouyancy-controlled gates which do not need outside control. The three detention basins are designed to release flood waters in conjunction with the other features of the project in a coordinated manner.

b. Mill Ditch Flows. - Local interests have indicated a desire to make releases from the Fancher Creek headworks (Limbaugh) to Mill Ditch during flood events when downstream flow conditions permit. Redbank Detention Basin control structure design allows for limited releases from Limbaugh up to about 75 cfs.

c. Monitoring and Reporting. - Normal project flood control operations will include daily monitoring of flows and reservoir and detention basin stages to facilitate the appropriate changes of control gates throughout the Fresno - Clovis flood control system, as described in the GDM. The FMFCD will be responsible for maintaining complete and accurate records for each feature of the project. A complete operation record for Pup Creek, Alluvial Drain, and Redbank Creek Detention Basin will be made available to the Corps of Engineers upon request. Permanent operating equipment and hydrologic and hydraulic data collection equipment are described in Chapter II - Description of the Features.

58. Maintenance and Replacement. - Normal maintenance and replacement associated with the basins, embankments, outlet works, channels, service roads, and associated equipment will be performed by the FMFCD in compliance with the Maintenance Manual, to be prepared during construction.

a. Embankments and Cut Slopes. - The provisions for embankment maintenance are spelled out in Paragraph (b) Levees, Section 208.10, Title 33 of the Code of Federal Regulations and any special instructions provided for this project. Measures are to be taken to promote the growth of sod on the earth embankments and cut slopes. All such embankment and cut slopes are to be kept mowed.

Operation, Maintenance and Inspection of Completed Work

The soil cement embankments are to be kept free of vegetation and other debris. These areas are to be inspected annually. Additionally, efforts will be required to prevent damage to embankments by burrowing animals.

b. Channels. - The FMFCD will be required to perform maintenance, operation, and inspection of all project exit channels in accordance with Section 208.10, Title 33 of the Code of Federal Regulations and any special instructions provided for this project. These regulations require a regular program of maintenance and inspection.

All project channels, including rerouted Mill Ditch, must be maintained to their design grade, invert elevation, and capacity. Sediment and debris are to be removed from the exit channels and culverts as required to maintain the design capacities. FMFCD will be responsible for recording exit channel flows so that the effects of vegetation and other debris on channel capacity can be determined. Information regarding the functional capability of the project is to be reported annually.

c. Erosion Protection. - Riprap and compacted clay placed as part of the project will be maintained and any additional erosion control needed over the life of the project will be provided by the FMFCD. Erosion protection is to be kept free of vegetation and shall be inspected annually.

d. Basin Sediment Removal. - At least every 30 years (as indicated in Chapter III - Hydraulic Design and Hydrology) and after each major flood event sediment deposition in Pup Creek and Alluvial Drain detention basins will be evaluated to determine if removal is required to maintain the design flood storage capacity of the basins. In addition, the sediment trap at Redbank Creek Detention Basin will be evaluated every three years for sediment removal.

After construction of the Redbank Creek Detention Basin, and for a period of five years thereafter, the sediment trap profile and cross section will be monitored to identify potential deposition and head cutting in time to allow for remedial maintenance.

e. Service Roads. - The service roads will be kept in usable condition at all times.

f. Control Structures. -

(a) Pup Creek and Alluvial Drain Detention Basin. - The trash racks will be kept clear of debris.

(b) Redbank Creek Detention Basin. - The control gates will be maintained in accordance with the manufacturer's recommendations and any Corps requirements specified in the Water Control and Maintenance manuals.

59. Miscellaneous Facilities. - Paragraph 101 of the February 1986 GDM describes the required operation and maintenance of existing facilities that are in the project area and used for flood control, are not part of the Redbank and Fancher Creeks project, but are required to meet project purposes.

Operation, Maintenance, and Inspection of Completed Work

60. Periodic Inspection. -- In accordance with Sec. 7, 58 Stat. 890, 33 USC 709, periodic inspections and reports shall be conducted, with Corps participation at the election of the Corps, for each facility comprising the Redbank and Fancher Creeks, California project. The purpose of such inspections is to insure continuing functional adequacy of each basin and associated structures. In addition, because the existing irrigation canals are a primary means of diverting surface flows during floods, annual project inspection will include the canals.

61. Operation and Maintenance Costs. -- The estimated annual operation and maintenance costs for each detention basin is shown below:

<u>Detention Basin</u>	<u>Annual OM&R Costs</u> (\$)
Pup Creek	3,500
Alluvial Drain	4,300
Redbank Creek	<u>45,000</u>
	52,800